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DATE

Dr. Michael Feuerstein — 3/30/12
DEPARTMENT OF MEDICAL AND CLINICAL PSYCHOLOGY
Committee Chairperson

Dr. Andrew J. Waters — 3/30/12
DEPARTMENT OF MEDICAL AND CLINICAL PSYCHOLOGY
Dissertation Advisor

Dr. Neil E. Grunberg — 3/30/12
DEPARTMENT OF MEDICAL AND CLINICAL PSYCHOLOGY
Committee Member

Dr. Cara H. Olsen — 3/30/12
DEPARTMENT OF PEVENTIVE MEDICINE AND BIOMETRICS
Committee Member

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Jessica O. Forde
Department of Medical and Clinical Psychology
Uniformed Services University
30 March 2012

ABSTRACT

Title of Dissertation: Social Desirability Bias in Cigarette Smoking Cessation: Effects in the Laboratory and Field

Jessica O. Forde, M.S., 2012

Thesis directed by: Andrew J. Waters, Ph.D.
Associate Professor, Director of Graduate Education
Department of Medical and Clinical Psychology

Social desirability response bias (SDR) is the tendency of individuals to respond in a way that will be viewed favorably by others. Concern about the effect of SDR has motivated the development of implicit assessments which may be less sensitive to SDR than are self-report measures. However, little research has examined the effect of SDR on implicit measures, particularly within the context of cigarette smoking cessation. Adult cigarette smokers from the Houston, TX, and Washington, DC, metropolitan areas were recruited for smoking cessation treatment. Participants were assessed at two pre-quit sessions (12-hours abstinent and smoking normally), quit day, and two sessions post-quit. At each session, participants completed implicit and explicit (self-report) measures

assessing attitudes toward smoking, craving/attentional bias, and outcome expectancies related to smoking. In addition, some participants participated in an ancillary Ecological Momentary Assessment (EMA) study in which they completed implicit and self-report assessments on a personal digital assistant (PDA) for one week following their quit day. Study hypotheses examined: 1) the effect of SDR on self-report assessments; 2) the effect of SDR on implicit assessments; 3) whether SDR moderated the relationship between self-report and implicit measures; 4) whether the effect of SDR scores on self-report and implicit measures varied by smoking state (e.g. non-abstinent vs. abstinent); and 5) whether the effect of SDR on self-report and implicit measures varied by Setting (lab vs. field). Participants with higher (vs. lower) SDR scores reported lower craving ratings (lab and field) and less positive outcome expectancies. Participants with higher SDR scores reported less positive attitudes to smoking in the field. Attentional bias and implicit attitudes were not associated with SDR scores in the lab or in the field. There was limited evidence that SDR scores moderated the association between self-report measures and implicit measures. The effect of SDR on self-reported craving and outcome expectancies was greater on the quit-day than on the pre-quit abstinence session and, for self-reported attitudes, it was greater in the field (vs. lab). Overall, the results suggest that SDR may influence self-report measures, and that implicit assessments may be particularly useful in individuals with high SDR scores.

SOCIAL DESIRABILITY BIAS IN CIGARETTE SMOKING CESSATION: EFFECTS IN THE LABORATORY AND THE FIELD

by

Jessica O. Forde

Dissertation submitted to the Faculty of the

Medical and Clinical Psychology Graduate Program

Uniformed Services University of the Health Sciences

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Dedication

To my parents, Larry Floerchinger and Susan Spear

They taught me early in my life that I could achieve anything I put my mind to and have diligently supported me in this endeavor throughout the entirety of my life. My father, who has seen me through this process here on earth, and to my mother, who is seeing me through its completion looking down from heaven.

To my sister and brother, Jen and Lucas Floerchinger

They have kept me sane all these years and provided much needed distraction. They have never stopped believing that I could see this through and always reminded me not to take life too seriously…some of the best advice I've ever gotten.

To my amazing husband, Fidel Forde, and children, Adeline, Leola, and Magnolia

They have stood by my side day in and out and have sacrificed time right alongside me. They have supported me through long nights and busy weekends and have paid the price with me to see this dream come true. I look forward to experiencing life with them no longer as a student, but as a wife, mother, and clinical psychologist.

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List of Acronyms and Abbreviations

AB = 12 hour abstinent laboratory session (pre-quit)

BIDR = Balanced Inventory of Desirable Responding

CO = expired breath carbon monoxide (used to assess smoking status during lab sessions)

EA = Expectancy Accessibility Task (implicit outcome expectancies)

EMA = Ecological Momentary Assessment (repeated collection of real-time information [i.e., assessment] of an individual's current state [i.e., momentary] regarding behaviors and experiences in an individual's natural environment [i.e., ecological])

ESD = Edwards Social Desirability Scale

FTND = Fagerstrom Test of Nicotine Dependence

HIGH BIDR = participants with high BIDR scores (15+)

IAT = Implicit Association Test (implicit attitudes toward smoking)

IM = Impression Management scale of the BIDR

LOW BIDR = participants with low BIDR scores (0-14)

MCSDS = Marlowe-Crowne Social Desirability Scale

MDACC = MD Anderson Cancer Center (Houston, Texas)

NON = Non-abstinent laboratory session (pre-quit)

NSR = Non self-report measures

PDA = Personal digital assessment (method of assessment for ancillary EMA study)

QD = Quit day laboratory session

QSU = Questionnaire of Smoking Urges (self-reported craving for cigarettes)

SCQ = Smoking Consequences Questionnaire (self-reported outcome expectancies)

SDE = Self-Deceptive Enhancement scale of the BIDR

SDR = Socially Desirable Responding

SDS = Semantic Differential Scales (self-reported attitudes toward smoking)

SR = Self-report measures

Strategy 1 = BIDR analyzed as a binary variable by median split (LOW and HIGH)

Strategy 2 = BIDR analyzed as a continuous variable

Stroop = Modified smoking Stroop task (Attentional Bias; implicit measure of craving)

System 1 cognition = fast, automatic, and effortless form of cognition, representing an intuitive and unconscious form of cognitive processing

System 2 cognition = slow, controlled, and effortful form of cognition, representing a conscious, reason-based form of cognitive processing

USUHS = Uniformed Services University of the Health Sciences (Bethesda, Maryland)

WK+1 = laboratory session one week following participants' quit day

WK+4 = laboratory session four weeks following participants' quit day

Introduction

Response Bias

Response bias is "the systematic tendency to respond to a range of questionnaire items on some basis other than the specific item content" (Paulhus, 1991, p. 17). There are many forms of response bias, including acquiescence bias (tendency to agree; Lentz, 1938), careless response bias (Meehl & Hathaway, 1946), omission bias (Cronbach, 1946), extremity response bias (tendency to use extreme ratings; Peabody, 1962), deviant response bias (Berg, 1967), consistent response bias (Dillehay & Jernigan, 1970), and social desirability response bias (Bernreuter, 1933; Vernon, 1934). Social desirability response bias (SDR) is the tendency of individuals to respond in a way that will be viewed favorably by others. SDR can affect validity of data obtained through research and conceal the nature of relationships between variables of interest (Paulhus, 1991). SDR is thought to have the most significant effect when assessing topics that are potentially socially undesirable and of which participants would be more motivated to misrepresent self-reported information, such as religious orientation (Batson, Naifeh, & Pate, 1978), racism (Sigall & Page, 1971), sexual behaviors (Sprecher, McKinney, & Orbuch, 1987), and drug use (Mieczkowski, 1990).

Why does Socially Desirable Responding Occur?

There are several possible explanations for why SDR may occur. Social Comparison Theory (Festinger, 1954) suggests that individuals are driven to evaluate the accuracy of their opinions and abilities. In the absence of objective measures to evaluate this accuracy, individuals will use social measures, such as comparison with behaviors of others within their valued group. This social comparison process is initiated by a need to

affiliate and to be accepted within one's valued group and may increase pressure to conform with social norms and behave in a socially desirable manner (Schachter, 1959). An additional process at work is the need to increase cognitive consistency and decrease dissonance. Cognitive Dissonance Theory (Festinger, 1957) suggests that individuals strive toward consistency, including agreement between knowledge about themselves and the outside world (e.g., beliefs, attitudes, opinions, behaviors). Dissonance is reduced by rationalizing or changing one's belief or behavior to increase consistency. This process may also help to explain why individuals may be driven to behave in a socially desirable manner.

History of Social Desirability Research

SDR has been studied for more than 50 years, and many scales have been developed to measure SDR. These measures include stand-alone measures designed specifically to assess SDR, such as the Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1960) and scales built into preexisting measures to assess SDR and other forms of deceptive responding. In fact, many frequently used personality assessments have scales built-in to detect different forms of deceptive responding, such as the Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1975) and the second edition of the Minnesota Multiphasic Personality Inventory (MMPI-2; Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1989). These built-in scales allow for controlling and correcting for the effects of response biases, such as SDR and other forms of deceptive responding, on self-reported personality data.

Study in the area of SDR began with the development of the Edwards Social Desirability Scale (ESD; Edwards, 1957), which assessed SDR using 39 items from the

Minnesota Multiphasic Personality Inventory (MMPI; Hathaway & McKinley, 1951). The development of many other scales followed. However, due to concerns about the strong association between psychopathology and the ESD, Marlowe and Crowne developed a new scale that was not dependent on psychopathology-related content. The Marlowe-Crowne Social Desirability Scale (MCSDS; Crowne & Marlowe, 1960) consists of questions regarding socially sanctioned behavior with a low probability of occurrence in order to assess the degree of socially desirable responding. The MCSDS remains one of the most strongly validated and frequently used SDR scales today. Following the development of the MCSDS, attention continued to be paid to the effects of SDR on self-reported information, and many of the frequently used personality assessments began to develop built-in scales to detect deceptive responding, such as the Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1975) and the second edition of the Minnesota Multiphasic Personality Inventory (MMPI-2; Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1989).

However, correlations between SDR measures tend to be low. The first factor analyses of SDR were conducted by Wiggins (1964), who determined that there were two factors being assessed by social desirability scales. He labeled these factors as Alpha and Gamma, and illustrated that different scales loaded more heavily on the different factors. For example, the ESD was more strongly associated with the Alpha factor, whereas the MCSDS was more strongly associated with the Gamma factor (Wiggins, 1964). Damarin and Messick (1965) furthered Wiggins work by showing that these two factors were significantly different constructs of SDR. They argued that the Alpha factor consisted of an unconscious evaluative bias based on a defensive distortion of one's private self-

image, and is associated with self-esteem and ego-resiliency. Gamma factor was more accurately characterized as a deliberate evaluative bias based on a tendency to promote a desirable public reputation.

Sackeim and Gur (1978) were the first to attempt development of a measure that would assess these two factors separately, which they labeled as self-deception (i.e., Alpha) and other-deception (i.e., Gamma). Other-deception captures the standard conceptualization of social desirability, which is the deliberate and intentional attempt to present oneself in a favorable way, whereas self-deception assesses the unintentional but overly positive presentation of oneself (Sackeim & Gur, 1978). Evidence from more recent factor analyses provides support for these two distinct constructs in SDR (Lanyon & Carle, 2007; Paulhus, 1984).

While most researchers in the field of social desirability research now agree that there are two distinct factors at work in SDR, most scales continue to assess only one factor. For example, scales that assess other-deception include the MMPI-2 Lie scale, EPQ Lie scale, and the MCSDS, and scales that assess self-deception include the ESD and the MMPI-2 K scale. To date, only one measure has been created that allows for the ability to examine both factors together as well as independently. The Balanced Inventory of Desirable Responding (BIDR) was originally developed in response to the need for a measure of SDR that would assess both constructs of SDR, and was based on the scales developed by Sackeim and Gur (1978). BIDR factors include Impression Management (IM), which is the deliberate presentation of a positive public impression (i.e., Other-Deception, Gamma) and Self-Deceptive Enhancement (SDE), which is the unconscious enhancement of positive characteristics and denial of negative

characteristics (i.e., Self-Deception, Alpha). The BIDR will be discussed in depth later (see Introduction section, page 7), and the two factors of SDR will hereafter be referred to in terms of IM and SDE.

Dual Processing Theory and SDR

Dual processing theories propose two separate forms of information processing. System 1 is fast, automatic, and effortless and represents an intuitive and unconscious form of processing, whereas System 2 is slow, controlled, and effortful and represents a conscious, reason-based form of processing (Kahneman, 2003, 2011). Traditional self-report (explicit) measures, are hypothesized to assess controlled processes (System 2 cognition), whereas implicit measures (e.g., the Implicit Association Test, discussed later) are thought to assess automatic processes (System 1 cognition) (Epstein, 1994; Smith & DeCoster, 2001; Wilson, Lindsey, & Schooler, 2000). Dual processing models of information processing suggest that explicit measures may be more susceptible to the effects of rationalization and filtering, whereas implicit measures are hypothesized to be outside the individual's conscious control and therefore should not be susceptible to deliberate filtering processes.

Dual processing theories provide a useful framework for understanding how the two domains of SDR may function. Self-Deceptive Enhancement (SDE) is hypothesized to operate similarly to System 1 processing, in that it is thought to be an unconscious and automatic process. Impression Management (IM), however, is thought to be a more deliberate and controlled form of SDR, and therefore appears to operate in a similar manner to System 2 cognitive processes (see Figure 1). Therefore, IM may be more influential on explicit measures, whereas SDE may have an effect on the integrity of data

obtained through implicit measures if, for example, an implicit measure related to the self (i.e., implicit self-esteem) is assessed. Holtgraves (2004) found that higher levels of SDR, specifically the IM factor, resulted in slower response times in responding to questions regarding personality traits under varying conditions of social desirability. This study lends support to the hypothesis that IM may operate as an editing process in which individuals respond in a manner to create a deliberate perceived impression. Holtgraves (2004) also found that participants higher in SDE were able to respond more quickly, suggesting that SDE is a more automatic processing system than IM that does not require additional time for editing one's responses.

Another implication of the dual processing theory for SDR is that IM may be affected by cognitive load (e.g., increases in cognitive requirements leading to temporary impairments in cognitive abilities), as it is hypothesized to be a deliberate and effortful process, whereas SDE should be able to function regardless of cognitive load. Research suggests that incongruent self-presentations, thought to require more effort to maintain, can be negatively impacted by induced cognitive load (Pontari & Schelnker, 2000). In addition when self-regulation resources are depleted, through effortful self-presentation, it can negatively impact ability to maintain self-presentation patterns (Vohs, Baumeister, & Ciarocco, 2005). Another effect of cognitive load is that it may increase the positivity of one's self-presentation, suggesting that increased cognitive requirements may enhance levels of impression management (Paulhus, Graf, & Van Selst, 1989). However, this hypothesis has not been fully examined in research. The effects of cognitive load may be particularly relevant in cigarette smoking cessation research because individuals may be cognitively impaired when abstinent (Hughes, 2007a, 2007b; Sherwood, 1993), therefore

the effect of IM may differ across different smoking states and degrees of abstinence within the process of smoking cessation.

Balanced Inventory of Desirable Responding (BIDR)

In the current study the Balanced Inventory of Desirable Responding (BIDR; Paulhus, 1988) was used to assess SDR (see Appendix D). The BIDR consists of two subscales of 20 items each, an Impression Management (IM) subscale based on the traditional concept of other-deception and a Self-deceptive Enhancement (SDE) subscale based on the concept of self-deception. Sample items of the IM subscale include ‘‘I have received too much change from a salesperson without telling him or her’’ and ‘‘I have some pretty awful habits.’’ Sample items of the SDE subscale include ‘‘I have not always been honest with myself’’ and ‘‘I never regret my decision’’ (Paulhus, 1991, pp. 40-41). Participants rate their agreement with the statements on a 7-point Likert scale, with 1 indicating not true and 7 indicating very true. Each scale is counterbalanced with equal numbers of positively and negatively keyed items. Paulhus (1988, 1991) provides two scoring methods. In the continuous scoring method, points are added across all items and the raw score is used. In the dichotomous method, one point is given to extreme responses (i.e., 6 or 7) and all other responses receive zero points; this method is used to distinguish individuals endorsing the highest levels of SDR from those individuals endorsing standard levels. Therefore, the dichotomous system is the scoring method recommended for use by the author and was used in the current study. Both scoring methods can yield an IM score, an SDE score, or a combined total score of all 40 items (Paulhus, 1988, 1991).

Relationship with other measures of social desirability. The IM scale of the BIDR positively correlates with commonly used lie scales. Davies, French, and Keogh (1998) reported a correlation of +.61 between the BIDR IM scale and the EPQ-R Lie Scale, and the BIDR IM scale has been found to correlate highly with the MMPI-2 L Scale, as reported in Paulhus (1991). The MCSDS has been reported to correlate +.71 with the overall score of the BIDR (Paulhus, 1991). The MMPI-2 K scale, which was originally designed as a more subtle measure of deception, is one of the few scales to correlate significantly with the SDE scale of the BIDR, as reported in Paulhus (1991).

Controlling for Socially Desirable Responding

If a clear effect of SDR on explicit measures is observed, then Paulhus (1991) suggests five ways that an effect of SDR may potentially be controlled: demand reduction, stress minimization, factor analysis, rational method, and covariate method. Demand reduction describes a method of designing the research environment to minimize the motivation and opportunity for desirable responding. Strategies for demand reduction include increasing perceived anonymity and reducing assessment interactions with the researcher. Stress minimization involves choosing and utilizing assessments that will reduce the motivation for and likelihood of SDR. Factor analysis controls the effect of SDR by using statistical methods that will remove or account for the role of SDR in obtained data. The rational method focuses on designing assessments in a manner that will minimize the chance of SDR, such as controlling the types of questions used or the order of item presentation. Lastly, the covariate method uses a measure of SDR as a covariate in analyses so that the relationship between other items can be examined without the effect of SDR (Paulhus, 1991).

Use of Implicit Assessments

Since the Paulhus (1991) article was published, there has been increased interest in the development of assessment methods that may be less susceptible to the effects of SDR, such as implicit assessments. Research on these assessments suggests that if the steps proposed by Paulhus do not work adequately, then use of implicit assessment methods can be considered. In the current study, three different implicit measures were used to examine the effect of SDR. Stated briefly, the Implicit Association Test (IAT; Greenwald, McGhee, & Schwart, 1998) provides an implicit assessment of attitudes and has been used extensively in cigarette smoking research, showing that smokers exhibit a less negative (more positive) attitude toward smoking than do non-smokers (Swanson et al., 2001; Sherman et al., 2003; Waters et al., 2007). The IAT also has been used in research examining the effects of SDR on explicit and implicit measures (e.g., Egloff & Schmuckle, 2003; Hofmann, Gschwendner, & Schmitt, 2005; Nosek, 2005; Riketta, 2005).

The Modified Stroop task ("Stroop"; Williams, Matthews, & MacLeod, 1996) is a measure of attentional bias. Attentional bias is a measure of the degree to which personally salient cues automatically capture one's attention. Research has shown that cigarette smokers show an increased attentional bias to smoking-related stimuli (e.g., cigarettes, ashtrays) when compared to controls (Munafo et al., 2003; Waters & Leventhal, 2006). The Expectancy Accessibility task (EA; Palfai, 2002) is a measure of how accessible smoking outcomes are in an individual's memory. Research has shown that smokers tend to exhibit greater accessibility for positive smoking outcomes than non-smokers (Fallon, 1998; Litz, Payne, & Colletti, 1987). To the best of the author's

knowledge, no studies have been conducted which have examined the modified Stroop or EA tasks within the context of SDR research. The three tasks will be described in more detail below (see Procedure section, pp. 44-59).

SDR and Explicit Measures

SDR is thought to affect a wide range of explicit measures, and research provides support for the effect of SDR in topic areas such as self-reported behavior and explicit attitudes or affect (Adams et al., 2005; Bardwell & Dimsdale, 2008; Marissen et al., 2005). In assessing behaviors and attitudes that are socially driven (i.e., society tends to support one behavior or attitude over another), the effects of SDR are expected to be more extreme, thereby influencing the interpretation of responses on these explicit measures (Paulhus, 1991). However, few studies utilize SDR measures to directly examine this effect. van de Mortel (2005) conducted a literature review of all research listed in the Cumulative Index to Nursing and Allied Health Literature that was in English and had used a self-report measure. Of the 14,275 studies that were found, only 31 (.2%) used an SDR measure, and of the 31 studies, 13 (43%) found a significant effect of SDR on the data (e.g., tendency to under-report undesirable attitudes and behaviors). This review suggests that although SDR appears to be a meaningful variable in a wide range of research, inadequate attention has been paid to the systematic examination of the effects of SDR on measures in research.

In the review of studies below (see Table 1), studies were chosen that examined both the relationship between SDR and self-report measures and the relationship between SDR and a non self-report measures (i.e., biological, physiologic, or implicit measures). Articles were located through key word searches of SDR measures and through searching

relevant citations from articles located. Databases included PsychInfo, Pubmed, and Google Scholar and was open to articles from 1900-present. These studies enable a comparison of the differential effect of SDR on self-report (SR) and non self-report (NSR) measures in order to examine whether SDR has the same effect across different types of measures. Some of the included studies were previously reviewed in Forde (2010). To the best of the author's knowledge, the studies in Table 1 represent the extent of literature available that has compared the effect of SDR on SR and NSR measures. Some of the studies included in Table 1 also examined whether SDR moderated the association between SR and NSR measures; however this area of study is rather limited and is represented by the few studies in Table 1. Previous research on these relationships is discussed below. In this study, the term moderation is used to indicate the effect of a variable (e.g., SDR) in weakening or strengthening the relationship between other variables (e.g., the moderation effect of SDR on the relationship between explicit and implicit measures).

Influence of SDR on Explicit Attitudes and Cognitions

Research suggests that SDR can have a significant effect on explicit attitudes and thoughts, particularly those attitudes driven by social approval. Associations have been found between SDR and many different explicit attitudes and cognitions, such as self-esteem (Mesmer-Magnus, Viswesvaran, Deshpande, & Joseph, 2006; Riketta, 2005), negative affect (Bardwell & Dimsdale, 2001; Klassen, Hornstra, & Anderson, 1975), well-being (Diener, Suh, Smith, & Shao, 1995; Kozma & Stones, 1986), and drug craving (Marissen et al., 2005; Rohsenow et al., 1992).

Influence of SDR on Implicit Measures of Attitudes and Cognitions

Research on the effect of SDR on explicit behavior, attitudes, and cognitions suggests that self-report measures are limited by increased susceptibility to SDR. Implicit measures, as discussed above, are thought to measure thoughts and feelings that may not be readily accessible and are, therefore, theoretically outside the realm of conscious control (Greenwald, McGhee, & Schwartz, 1998). However, the systematic study of implicit measures is still in early stages. To date, few studies have been conducted that specifically examine the effect of SDR on implicit measures or the effect of SDR on the relationship between explicit and implicit measures. Historically, implicit and explicit measures of the same constructs have been weakly correlated (Greenwald et al., 1998). One meta-analysis, which examined the relationship between the Implicit Association Test and a variety of construct-related explicit measures, reported a mean correlation (*r*) of +.24 between the implicit and explicit measures (Hofmann et al., 2005). Research has shown that when the spontaneity with which explicit information must be reported is increased, the relationship between explicit and implicit measures increases as well (Hofmann et al., 2005). This research suggests that by removing the opportunity for deliberate filtering or response editing, the effects of SDR on explicit measures should be minimized and therefore increase the strength of the relationship between explicit and implicit measures of the same construct (Hofmann et al., 2005). This result also suggests that implicit measures may be less susceptible to this deliberate editing process. However, only a few studies have been conducted to directly examine this question.

In a study conducted by Egloff and Schmukle (2003), the authors examine the role of SDR on the relationship between explicit and implicit measures of anxiety in university students, using the State-Trait-Anxiety-Inventory (STAI; Spielberger, Gorsuch, & Lushene, 1970), an Anxiety Implicit Association Test (IAT), and the revised Social Desirability Scale-17 (SDS-17R; Stoeber, 2001). As expected, SDS scores were not associated with the anxiety IAT effect. While it was hypothesized that SDS scores would moderate (i.e., increase or decrease the strength of) the relationship between explicit and implicit anxiety, no moderation effect of social desirability was found in this study. The authors followed up with an investigation of whether SDR would moderate the association between the explicit and implicit anxiety measures when the two BIDR scales, IM and SDE, were analyzed separately. As in the previous study, the SDR measures were not associated with the anxiety IAT effect, and neither BIDR scale score significantly moderated the association between the implicit and explicit measures (Egloff & Schmuckle, 2003).

Similarly, Hofmann, Gschwendner, and Schmitt (2005) conducted a study examining the moderation effect of social desirability on the relationship between implicit and explicit measures of prejudicial attitudes of West Germans toward East Germans. A significant relationship was reported between a measure of attitude toward East Germans and Motivation to Control Prejudiced Reactions, a measure of social desirability ($r = +.41$, $p<.001$). However, there was no relationship between social desirability and the implicit attitude measure, and social desirability was not found to moderate the relationship between the explicit and implicit measures. It might be suggested that the topics of anxiety and attitudes toward East Germans may not be

socially driven enough for the moderator effects of SDR to be detected, particularly in the sample of university students who participated in the Egloff and Schmukle (2003) and Hofmann et al. (2005) studies. Additional research is needed to examine the associations between SDR and implicit/explicit measures, using a construct in which individuals may be more motivated to skew or misrepresent their self-reported attitudes.

Other topics, such as illicit drug use, should be significantly affected by misreporting on self-report measures, due to the illegality of illicit drug behavior and the social undesirability of these behaviors within mainstream society. However, only one study, has examined the effects of SDR on explicit and implicit measures of illicit drug use behavior, attitudes, and cognitions. Self-reported craving and physiological responses to heroin cues, using a sample of abstinent heroin abusers, was examined in a study by Marissen et al. (2005). Low correlations between these two cue reactivity measures are typically reported (Robbins, Ehrman, Childress, & Obrien, 1997; Tiffany, 1990), similar to low reported correlation between explicit and implicit measures. Marissen et al. (2005) examined three explicit measures of heroin craving and compared them with a measure of skin conductance to assess physiologic reactivity. The authors found an association between SDR and explicit heroin craving, such that those individuals with higher SDR scores had significantly lower levels of self-reported craving. These results suggest that SDR may influences explicit measures of illicit drug craving.

Physiologic measures can be compared to implicit measures in that they are less susceptible to deliberate manipulation than are self-report measures. In the Marissen et al. (2005) study, an association was not found between SDR and the skin conductance

measure (a physiologic measure of craving), indicating that only the explicit measure was affected by SDR. As in the Egloff and Schmukle (2003) study, SDR did not have an effect on the association between the self-report and non self-report measures (i.e., self-reported craving and physiologic response to heroin cues) in the Marissen et al. (2005) study. The results from these studies emphasize the importance of future research to understand the role that SDR may have on the validity of self-reported information, particularly when assessing socially undesirable domains such as drug use.

Two studies have been able to find at least partial support for the moderation hypothesis of SDR on the relationship of self-report and implicit measures. Riketta (2005) examined the effect of SDR on the relationship between self-report and implicit measures of self-esteem. This study compared one explicit measure with three different implicit measures and was able to find that SDR had an effect on the relationship between two of the implicit measures of self-esteem and the SDE scale of the BIDR. The IM scale was not a significant factor in these analyses. This effect was found even when controlling for gender, another variable that has been reported to affect the relationship between explicit and implicit measures.

Lastly, Nosek (2005) conducted a large scale Internet study examining the relationship between 57 different object pairs assessed through explicit measures and IAT tasks. More than 6000 participants completed more than 12,000 matched measures of each assessment type. This study did not use a standard measure of SDR, but instead used a measure of self-presentation which was composed of the mean of internal motivation to respond without negativity, external motivation to respond without negativity, and a calculation of an average person's motivation to appear without bias.

Self-presentation effect had a significant effect on the relationship between explicit and implicit object pairs. However, three other variables were found to significantly affect the implicit-explicit relationship as well (evaluative strength, dimensionality, and distinctiveness). These results suggest that SDR may play a role in the weak associations between implicit and explicit measures. However, it is likely that there are additional variables that may also explain the weak relationships commonly found between implicit and explicit measures. Taken together, these last two studies provide support for the hypothesis that SDR may have a significant effect on the implicit-explicit relationship; however, it is important to continue to explore how SDR affects these measures, particularly when assessing areas that are more prone to the effects of social desirability.

Influence of SDR Across Settings

Limited research has examined changes in the relationship between SDR and explicit measures across different settings and administration conditions. For the most part these studies have examined computer vs. paper and pencil administration and differences between anonymous and identified testing conditions, but most have examined differences in SDR or explicit measures separately across settings. Table 2 summarizes the most relevant research in this area. Only two studies specifically reported changes across settings that took into account both SDR and explicit measures. Tooze et al. (2003) examined differences in reported energy intake across multiple measures of intake: a paper and pencil assessment, self-report measure completed at home, a face-to-face interview completed with a clinician, and a physiologic measure of energy intake. SDR was predictive of underreporting of energy intake in the face-to-face interview but not in a written measure of energy intake, when verified through a

physiologic measure of intake, suggesting that lack of anonymity in the face-to-face interview increased participants' motivation to misreport their energy intake.

Likewise, Lajunen and Summala (2003) found that scores on a questionnaire of automobile driving behavior differed across public and private test settings (i.e., differing on level of participant anonymity) and that this effect disappeared when controlling for IM scores. The authors found that participants in the private, more anonymous, test condition were significantly more likely to report undesirable driving behaviors, and they concluded that differences in self-reported driving behavior across the two settings were caused by IM.

The other studies presented in the table indicate that different settings may minimize the effect of SDR. While this possibility has not been examined in conjunction with explicit measures, it suggests that certain test conditions may decrease levels of SDR, which likely affect the accuracy of explicit measures. Most of these studies suggest that the higher the participant's perceived sense of anonymity, the lower the effect of SDR on explicit measures (Booth-Kewley et al., 1992; Lajunen & Summala, 2003; Lautenschlager & Flaherty, 1990; Paulhus, 1984; Rosenfeld et al., 1996). Likewise, these studies suggest that if the testing context provides high levels of motivation to positively present oneself (i.e., applying for a job), then the effect of SDR will be increased (Rosse, Stecher, Miller, & Levin, 1998; Wilkerson, Nagao, & Martin, 2002). Additionally, these studies suggest that the IM factor of SDR, specifically, is likely minimized when participants believe that their responses are anonymous or when there is low or no motivation to impression manage. The differential effect of setting on the two factors of SDR, however, has not been clearly established in previous studies.

The last line of research relevant to this discussion is studies that have examined differences in explicit measures across settings by using measures that can be verifiable through other sources. For example, Kreuter, Presser, and Tourangeau (2008) conducted a survey on 1500 university alumni asking questions that were both socially desirable (e.g., giving money to the university), as well as socially undesirable (e.g., failing a class). The surveys were conducted using three different modes of administration, including an interviewer-conducted telephone interview, a self-administered telephone interview, and a self-administered web survey. Participants in the self-administered conditions, particularly the web condition, were more likely to report undesirable university activities such as failing a class or receiving a low grade point average (GPA). There also were higher levels of misreporting in the interviewer-conducted telephone interview on university-verified data, such as GPA and scholastic aptitude test (SAT) scores. Although SDR was not directly assessed in this study, the results suggest that changes in the level of perceived anonymity affect the integrity of self-reported information, possibly through affecting levels of SDR.

Wilkerson, Nagao, and Martin (2002) also reported that participants providing information as part of a job interview were more likely to misreport verified academic information when compared to participants completing a consumer survey, again suggesting that SR data may become less accurate as the motivation to present oneself favorably increases. In addition, research has suggested that when participants think that their answers will be verified through outside data (i.e., via actual verification or a bogus pipeline), they are less likely to provide socially desirable responses on self-report measures (Gannon, Keown, & Polaschek, 2007; Sigall & Page, 1971).

No studies to date have examined differences in the effect of SDR between the laboratory and individuals' natural environments, and no studies have been conducted examining data completed on a personal digital assistant (PDA). The studies highlighted above support the hypothesis that increasing perceived anonymity and decreasing motivation to impression manage likely decreases the effect of SDR on self-report data. Providing assessments outside of the laboratory may potentially provide an increased sense of anonymity and encourage participants to provide more accurate self-report information. In the current study, assessments from multiple laboratory sessions were used, as well as assessments conducted outside the laboratory in the participants' natural environment (see Ecological Momentary Assessment section below), so it was possible to conduct a direct examination of differences in SDR across two experimental settings. In addition, it was possible to explore how the IM and SDE factors of SDR are differentially affected by setting changes, which has also not been thoroughly examined or clarified in the current available research.

Ecological Momentary Assessment

Ecological Momentary Assessment (EMA) is defined as any method of assessment that utilizes repeated collection of real-time information of participants' current states (i.e., momentary) regarding behaviors and experiences in an individual's natural environment (i.e., ecological) (Shiffman & Waters, 2004). Previous research suggests that information recall is prone to error and systematic biases and may not be accurate (e.g., Bradburn Rip, & Shevell, 1987; Clark & Teasdale, 1982, Shiffman et al., 1997). The momentary aspects of EMA aid in decreasing biases associated with retrospection, while the ecological aspects allow for generalization to the "real world"

(i.e., ecological validity). Because EMA utilizes repeated assessments, it allows researchers to capture the dynamic and variant nature of the individual's behaviors and cognitions over time and across situations and to assess strategically at moments or events of interest (e.g., temptations to smoke a cigarette). These characteristics associated with EMA methods allow for increased ability to examine individual differences, temporal sequences, contextual associations, and the interactions of different factors (Shiffman, Stone, & Hufford, 2008).

While all EMA methods include repeated assessment in real-time and in the natural environment, specific methods of gathering information differ. Methods vary by assessment target, as well as by types of assessments being used. EMA methods can include paper and pencil or electronic diaries (e.g., Green et al., 2006), telephone assessments (e.g., Perrine, Mundt, Searles, & Lester, 1995), ambulatory physiological monitoring (e.g., Kop et al., 2001), and hand-held computers or personal digital assistants (PDA) (e.g., Shiffman, Paty, Gnys, Kassel, & Hickcox, 1996). The benefits of the development of PDA methods of EMA data collection is that they can be programmed to assess randomly or at predetermined time points of interest, and compliance can be closely monitored (Shiffman et al., 2007; Waters & Li, 2008). In addition, cognitive assessments can be administered on a PDA (Waters & Li, 2008; Waters, Miller, & Li, 2010) EMA methods of assessment have been used to study a full range of psychopathology and psychology-related domains, such as depression, pain, social support, and addiction (Shiffman et al., 2008).

In cigarette smoking cessation, EMA methods allow researchers to track changes in an individual's behaviors and experiences throughout the cessation process. This

monitoring allows for closer study of changes that may occur throughout a quit attempt and during a moment of relapse. These data are informative in that they provide more in-depth analysis into the changes that occur over time and also different personal and environmental factors which may affect the cessation process. EMA methods have been used to examine multiple mental, emotional, and physical changes that occur during smoking cessation, including changes in withdrawal symptoms over a quit attempt (e.g., McCarthy, Piasecki, Fiore, & Baker, 2006), changes in affect before and after a lapse or relapse (e.g., Shiffman & Waters, 2004), and cognitive predictors of relapse during a quit attempt (e.g., Shiffman et al., 2007).

In the current study, participants had the option of taking part in an ancillary EMA study in which random assessments were completed on a PDA for one week following their quit day. Explicit and implicit assessments of craving/attentional bias and attitudes toward cigarette smoking were given on the PDA and at each of the laboratory sessions, allowing for a comparison between the two settings to determine the differential effect that SDR may have in the laboratory vs. in one's natural environment. It was hypothesized that data obtained through explicit measures would be more accurate (i.e., less sensitive to SDR) on the PDA than in the laboratory due to an increase in perceived anonymity on assessments completed outside the laboratory.

Influence of SDR Across Cigarette Smoking States

In past research, SDR bias has been assumed to be a stable trait that has the same effect across situation and time (Edwards, 1953; Phillips & Clancy, 1972). However, some researchers have suggested that SDR bias represents a state-trait variable that differentially affects measures according to the situation that the individual is being

assessed in, as well as changes in the person's state (Schmitt & Steyer, 1993). Schmitt and Steyer (1993) examined the stability of the Marlowe-Crowne Social Desirability Scale (MCSDS; Crowne & Marlowe, 1960) across multiple testing times and found that variance between scores at different administration times was due to both situational changes and changes within the person, suggesting that a state-trait model may be more appropriate for SDR bias. However, this question has not been adequately examined in research.

Research has reported differences in many types of measures across varying states, such as implicit and explicit attitudes toward cigarette smoking (Sherman et al., 2003), attentional bias (Gross, Jarvik, & Rosenblatt, 1993) and craving (Willner & Jones, 1996), and outcome expectancies (Kirchner & Sayette, 2007). It is possible that some of the variance found across states may be due to differential effects of SDR. However, to the best of the author's knowledge, no studies have been conducted yet directly examining the effect of SDR across different manipulated states. In the current study, assessments were conducted across multiple time points and states (e.g., when abstinent vs. when smoking as usual; pre-quit vs. post-quit), allowing for examination of how the effect of SDR may be different across these assessment points and across different levels of motivation. Data were available from two pre-quit sessions (when abstinent and when smoking as usual), as well as three post-quit sessions (quit day, one week following quit day, and four weeks following quit day).

There is a significant body of research that suggests that acute tobacco abstinence hinders cognitive functioning, such as attention, memory, information processing, concentration, and decision making (Hughes, 2007a, 2007b; Sherwood, 1993). As

suggested previously, IM is thought to be a more deliberate and effortful process. Therefore, one might hypothesize that IM would have less of an effect in the abstinent pre-quit session than in the non-abstinent pre-quit session because the effort needed to impression manage would create too great of a cognitive load for an acutely abstinent smoker. Stated another way, individuals high in IM may be less able to impression manage when abstinent due to reduced cognitive functioning. On the other hand, one might hypothesize that the motivation to impression manage may be greater on the quit-day session than, for example, on the abstinent pre-quit session, because the participant is actually engaging in the quit attempt and, therefore, wants to create a good impression in front of the researcher and/or the therapist. Data available for this study enable differences in SDR to be examined both prior to quitting, as well as at additional stages in the early quit attempt, allowing for a more in-depth examination of the differential effects of SDR across the cessation process.

Differential Influence of IM and SDE on Self Report and Implicit Measures

Many studies that have examined the effect of SDR on measures have focused on the IM factor of SDR because it has theoretically been thought of as a conscious act of data manipulation and, therefore, as a variable that could be controlled for by the researcher or study design (Paulhus, 1991). However, little research has been conducted that has examined the potential of a differential effect of IM and SDE on different constructs and types of measures. As discussed previously, IM is less likely to affect implicit measures because these measures are thought to tap into a level of information outside of the individual's control. However, there may be measurement constructs in which the SDE factor has an influence on implicit assessments.

Paulhus and John (1998) proposed that IM operates under a social approval motive in which individuals are driven to enhance their image as a good member of society and socially competent (termed a moralistic bias). SDE is assumed to operate on a premise of ego enhancement and as a tendency to see oneself as exceptionally talented (termed an egoistic bias). So in this definition, it is not differing degrees of consciousness that distinguish between these two constructs of SDR, as previously postulated, but rather the content of information being sought out. Based on the Paulhus and John (1998) conceptualization, IM and SDE would be expected to affect measures differently based on the content being assessed. Paulhus and John (1998) suggest that IM is most likely to affect information related to traits that reflect an external evaluation of self, such as Agreeableness and Conscientiousness. SDE is most likely to affect reporting of traits that reflect more of an internal evaluation of self, such as Extraversion, Openness to Experience, and Neuroticism (Emotional Stability). However, there is little research that has examined this postulate.

Pauls and Stemmler (2002) conducted a study in which they examined the relationship of IM and SDE with bias scores on a measure of the "Big Five" personality traits (i.e., Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness). IM was correlated with bias scores of Agreeableness and Conscientiousness, whereas SDE was correlated with bias scores of Extraversion, Neuroticism (Emotional Stability), and Openness. Another study reported that SDE was associated with higher self-esteem (Paulhus & Reid, 1991). Relatedly, multiple studies have found that cultural factors related to collectivism (e.g., social reliance, community, focus on shared goals and attitudes of the in-group) are associated with IM, and cultural

factors related to individualism (e.g., self-reliance, individuality, focus on personal goals and attitudes) are associated with SDE, suggesting that SDE assesses more me-focused information and IM assessed more other-focused information (Bernardi, 2006; Heine, Lehman, Markus, & Kitayama, 1999; Lalwani, Shavitt, & Johnson, 2006; Lalwani, Shrum, & Chiu, 2009). These studies support the hypotheses generated by Paulhus and John (1998) and suggest that IM may be more influential when assessing constructs that are related to society's view of the individual, whereas SDE may be more influential when assessing constructs related to the individual's view of him or herself. Based on this hypothesis, it may be possible for SDE to have an effect on implicit measures, previously thought to be outside the realm of SDR's effect, if the implicit measures assess domains related to an evaluation of the self (see Figure 2). The Paulhus and John (1998) premise of egoistic and moralistic bias in SDR has not previously been examined outside the context of personality traits, so it is unclear how IM and SDE would differentially affect other types of measures, particularly during an experience such as smoking cessation.

The traditional theory of SDR states that the two factors of IM and SDE differ based on variant levels of consciousness, with IM being a conscious and deliberate bias and SDE being an automatic and unconscious bias. The alternate theory (Paulhus & John, 1998) presented here states, rather, that IM and SDE differ based on differences in the content being assessed with IM having more of an effect on external based information and SDE having more of an effect on internal based information. However, little research exists to support either theory, particularly across different types of assessments (i.e., explicit and implicit) and different constructs (i.e., external and internal

assessment content). It has been proposed that IM should be more affected by situational demands and less consistent across contexts and time points, and SDE should be more stable and trait-like (Paulhus, 2002). The proposed study may aid in clarifying the differential effect of IM and SDE on different types of measures across different settings and time points and provide support for one of the theories.

In sum, if SDR depends on levels of consciousness (i.e., Dual Processing model), then it would be expected that the explicit measures would be most affected, and primarily by the IM factor, whereas the implicit measures should be relatively unaffected by SDR. If SDR depends on content (i.e., the Egoistic and Moralistic Bias Theory), then IM should have the greatest effect because the measures used in the current study do not assess ego-based content. SDE would likely have little effect on the study measures. If this study included measures specifically related to self-evaluation (e.g., explicit and implicit measures of self-esteem) in addition to the measures being used, then SDE would be expected to show a strong differential effect on these measures over IM. Therefore, IM should influence the self-report measures used in this study more than SDE. There are still many unanswered questions as to how SDR operates and what is the most accurate framework to understand this construct. The present study may be an informative first step toward clarifying how SDR operates.

Cigarette Smoking and Cessation

There are many forms in which individuals utilize tobacco, including cigarettes, cigars, pipes, and smokeless tobacco. The current study focuses on tobacco use in the form of cigarettes only, and cigarette smoking and cigarette smokers will hereafter be referred to as smoking and smokers respectively. There are approximately 1.3 billion

smokers worldwide (20% of the total population) and 45.3 million smokers in the United States (2.8% of the national population), making it the most common method of tobacco use (Center for Disease Control and Prevention, 2008). Smoking has been linked to many adverse health effects, including cancer, cardiovascular disease, and lung diseases. It is the primary preventable cause of death and kills 5 million individuals worldwide, 440 thousand in the United States, each year. In fact, half of all smokers will die prematurely from health problems and diseases associated with their tobacco use (U.S. Department of Health and Human Services, 2004).

Tobacco use is even more prevalent in the United States military. Current rates of use are around 30% of the total military population. Use has an inverse relationship with rank, with rates of use at over 50% in the lower ranks. Tobacco use is the single best predictor of early discharge and costs the Department of Defense almost one billion dollars annually in smoking-related healthcare (Bray et al., 2003).

Nicotine is the primary chemical of addiction in tobacco and is easily absorbed and distributed throughout the body via the skin, mucous membranes, and respiratory and gastrointestinal tracts. Nicotine reaches the brain within moments after inhalation from a cigarette where it has many different effects. Nicotine activates the mesocorticolimbic dopamine pathway, which is primarily associated with the reinforcing and rewarding aspects of nicotine use and plays a causal role in many forms of addiction. Other important brain actions of nicotine include increased serotonin release (thought to help regulate mood), increased hippocampal activity (thought to enhance memory), and variation in brain wave activity (thought to contribute to nicotine's attention, alertness, and arousal effects) (Grunberg & Starosciak, 2010).

Smoking behavior is initiated and maintained based on a number of different motivating factors, which will be briefly highlighted. Social factors appear to be very influential in smoking initiation, such as peer pressure (Marlatt,1982), behavioral and attitude modeling by parents, peers, and media sources (Bandura, 1977; 1986; Grunberg & Starosciak, 2010), and social and group identity with smoking (Collins, Maguire, & O'Dell, 2002; Lloyd, Lucas, & Fernbach, 1997). However, other psychological and biological factors seem to play a role in initiation as well, such as perceived benefits from smoking (e.g., weight control, mood regulation, cognitive enhancement) (Grunberg & Starosciak, 2010), early exposure to nicotine (e.g., maternal smoking during pregnancy) (Levin, McClernon, & Rezvani, 2006), and genetic contributions to individual differences in nicotine sensitivity and reward (Pomerleau, 1995).

Biological and physiological factors seem to take over primary importance in smoking maintenance, such as nicotine dependence (Russell et al., 1974; U.S. Department of Health and Human Services,1988), tolerance (Grunberg & Starosciak, 2010), physiologic rewards (e.g., stimulation, sedation, euphoria) (Russell, Peto, & Patel, 1974), weight management (Grunberg & Starosciak, 2010), and individual differences in nicotine sensitivity (Pomerleau, 1995). However, social and psychological factors still remain influential, such as perceived cognitive effects (e.g., enhanced information processing, alertness, concentration) (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004; Collins et al., 2002), negative reinforcement of smoking behavior through reduction in withdrawal symptoms (Baker et al., 2004; Russell et al., 1974), classical conditioning to smoking cues (e.g., attentional bias) (Cox, Fadardi, & Pothos, 2006; Robinson & Berridge, 1993; Waters, Shiffman, Bradley, & Mogg, 2003), affect regulation (Collins et

al., 2002; Tomkins, 1968), perceived stress reduction (Grunberg & Starosciak, 2010), and the social factors important in initiation (see above).

Many of these factors can also help explain the process of relapse and why smoking cessation is difficult to achieve and maintain. Withdrawal symptoms, such as depressed mood, anxiety, insomnia, irritability, difficulty concentrating, and increased appetite, appear to be particularly impactful in relapse to smoking (Grunberg & Starosciak, 2010). Additionally, changes in affect (positive and negative) and response to cues (e.g., attentional bias) may be predictive of relapse as well (Cox et al., 2006; Shiffman, 1986). Concerns regarding the negative impact of abstinence on cognitive abilities (Baker et al., 2004), body weight (Grunberg & Starosciak, 2010), and stress coping (Grunberg & Starosciak, 2010) may also contribute to relapse. Likewise, social factors remain significant in relapse and successful abstinence. One study illustrated that one's social network plays a role in successful cessation, whereas cessation by a sibling, coworker, friend, or spouse decreased individuals' continued use of tobacco by 25-67% (Christakis & Fowler, 2008).

The data for the current study was gathered as part of a larger smoking cessation study, "Cognitive Processes in Smoking Cessation," hereafter referred to as the parent study. The purpose of the parent study was to examine if there are factors, particularly cognitive factors, which may be predictive in relapse, with the goal of increasing rates of successful smoking cessation. The aim of the current study is to improve understanding of the role of SDR on explicit and implicit assessments obtained from smokers trying to quit smoking, in order to understand how SDR and the process of quitting may affect the accuracy of the data obtained from these individuals. If the accuracy of assessment

information obtained during cessation can be enhanced by more fully understanding the effect of SDR on these assessments, then it may increase the ability to predict relapse or successful cessation using this assessment information. This is the potential contribution of the current study.

SDR in Smoking Cessation Research

SDR may be particularly relevant in cigarette smoking research. With the increase in cigarette smoking restrictions, the behavior seems to be increasingly undesirable in society. In a recent national survey, the majority of American adults disapproved of smoking and supported public smoking bans, with numbers varying from 43-79% based on public location of the ban (United States Department of Commerce, 2008). This number has been increasing each year that the survey has been conducted. With this increased undesirability, the motivation to misreport smoking status or under-report use increases (Swanson et al., 2001; Sherman et al., 2003). Researchers have suggested that the weak relationship between explicit and implicit attitudes toward cigarette smoking may be the result of efforts to consciously control explicit attitudes due to stigmatization of smoking behavior in modern society (Swanson et al., 2001; Sherman et al., 2003). However, few studies have directly examined this hypothesis.

Boyd, Windsor, Perkins, and Lowe (1998) examined misclassification rates of smoking status in a sample of pregnant smokers by comparing self-reported smoking status with status determined by saliva cotinine levels. Cotinine is the primary metabolite of nicotine and measuring salivary levels allows for a physiologic measure of nicotine intake, which is the primary drug of addiction in tobacco (Ossip-Klein et al., 1996). Salivary cotinine is a common measure used to validate self-reported use and abstinence,

as it has been shown to be an accurate measure of cigarette smoking (Ossip-Klein et al., 1996). In the Boyd et al. (1996) study, the authors found a misclassification rate for self-reported nonsmokers of 26.2%, as compared to 0-9% in the general public. SDR was not measured in this study, so conclusions are limited. However, a possible interpretation of these results is that the increase misclassification rate in pregnant smokers may be driven by strong, negative societal opinions toward smoking during pregnancy (Boyd et al., 1998). Presumably, individuals scoring highest on an SDR measure would be most likely to misreport smoking status. Similarly, Dolcini, Adler, and Ginsberg (1996) conducted a meta-analysis examining factors that might influence the relationship between self-reported smoking and biological markers of tobacco use in an adolescent cigarette smoking population. As in the Boyd et al. (1998) study, SDR was not directly measured in this meta-analysis; however, SDR was hypothesized to be an important factor in explaining discrepancies commonly found between self-report and biological measures of cigarette smoking in this population.

The current study examined the effect of SDR on explicit and implicit measures over the duration of the smoking cessation process, as SDR may be differentially important across stages in the process of quitting. For example, smokers who express a desire to quit may be motivated to under-report their craving even prior to making a quit attempt (see Marissen et al., 2005). Likewise, they may be motivated to over-report their negative attitudes to smoking prior to a quit attempt as well. This under- and over-reporting may be more extreme for individuals with higher SDR scores. In addition, smokers also may be motivated to under-report craving on the day of a quit attempt and in the early stages of quitting. Clarifying the effect of SDR throughout the multiple

stages of smoking cessation will increase understanding of which assessments are most susceptible to SDR, as well as in what settings and at what stages in cessation the effect is greatest, so that it will be possible to more adequately control for this effect.

Possible Effects of SDR on Self-report Measures in Smoking Cessation

The research currently available on the effects of SDR does not provide a clear picture as to the effects of SDR on self-report measures, specifically in smoking cessation research. Therefore, it is important to consider the general way that SDR may influence self-report data and how SDR may affect the relationship between self-report and implicit measures (Figures 3-5). The figures provided are models that help to illustrate the potential effect of SDR on measures in smoking cessation research. The hypotheses illustrated in the figures have not yet been examined specifically in research. The descriptions of these models below are taken from the author's Master's Thesis (Forde, 2010).

Figure 3 illustrates an example in which the effect of SDR is similar across all participants high in SDR (i.e., individuals with the greatest degree of manipulation based on social desirability). The top left-hand graph represents those individuals low in SDR who would not be expected to manipulate their responses at all. The bottom left-hand graph is the same as the top left-hand graph because the responses of individuals low in SDR would not be expected to show an effect due to SDR. The "x" is the centroid of the data. The top right-hand graph represents individuals high in SDR who would be expected to manipulate their responses, in this case to report more negative attitudes. Finally, the bottom right-hand graph illustrates the changes expected in the mean, correlation between explicit and implicit attitudes, and the slope due to the effect of SDR.

As can be seen in these graphs, explicit attitudes would be expected to shift down, with high SDR participants reporting more negative attitudes. No difference in implicit attitudes would be expected. Under these circumstances, because the effect of SDR is similar across all high SDR participants, the correlation and slope would not be expected to change.

Second, as illustrated in Figure 4, the effect of SDR may vary randomly across all participants high in SDR. In this example, the mean of the explicit attitudes would be expected to shift down, with high SDR individuals reporting more negative attitudes. Because the scatter of responses would likely increase, this variance would weaken the correlation between explicit and implicit attitudes. However, because the variance would be randomly distributed across individuals, the slope of the regression line would not be expected to change significantly.

Third, as illustrated in Figure 5, the effect of SDR may be greatest for individuals with the most positive "true" responses, due to floor effects. So in this example, individuals with the most positive "true" explicit attitudes would be expected to distort their responses more than individuals with less positive "true" explicit attitudes. Individuals with very negative attitudes would be unable to make their responses much more negative because they are already at the bottom of the scale. In this case, the mean explicit attitude would likely decrease, the slope of the regression line would flatten, and the correlation would likely weaken due to the decreasing slope.

In sum, individuals with higher SDR scores would report more negative attitudes in all three of the examples discussed above. Under certain conditions, the correlation between explicit and implicit attitudes would be expected to weaken in high SDR

participants. The slope of the regression line, relating explicit and implicit attitudes, would be expected to flatten in the high SDR participants in situations where floor effects are present. These hypothesized effects do not address potential changes that may be found at different stages in the cessation process, such as when abstinent or during a quit attempt. They also do not address the differential effects of SDR that may be seen across different settings as well. The goal of the current study was to clarify these effects.

Preliminary Analyses

In preliminary analyses (Forde, 2010), the author examined the effect of socially desirable responding (SDR) on self-report (SR) and non self-report (NSR) measures across smoking states in a smoking cessation research program. Specifically examined were measures of smoking rate/nicotine use, attitudes toward smoking, and craving. In addition, the moderation effect of SDR on the relationship between these SR and NSR measures was examined. Significant differences were found in SR attitudes toward smoking and craving between individuals low and high in SDR, such that high SDR participants reported significantly more negative attitudes toward smoking ($t[102] = 2.24$, $p = .03$; see Figure 7) and lower levels of craving ($t[102] = 2.13$, $p = .04$). This finding suggests that SR measures of attitudes and cognitions in smoking cessation may be influenced by SDR. However, no significant differences were found between individuals low and high in SDR for reported smoking ($t[100] = -.4$, $p > .10$), suggesting that SR nicotine use was not significantly affected by levels of SDR (Figure 9). There were no differences between low and high SDR participants on implicit attitudes toward smoking ($t[103] = .46$, $p > .10$; see Figure 7) or on a biological measure of nicotine use (cotinine

levels in saliva) (t[103] = -1.57, p > .10), suggesting that these measures may be less susceptible to the effects of SDR than their self-report counterparts.

In addition, some support was found for an effect of SDR on the relationship between SR and NSR measures, as there were significant associations found between SR and NSR measures in the low group that did not exist in the high group (e.g., r[53] = .29, p = .03 in the low group vs. r[49] = .02, p > .10 in the high group for implicit and explicit attitudes toward smoking). This result suggests that higher levels of SDR may weaken the relationship between SR and NSR measures (see Figure 8). However, some of these associations were not significantly different from each other (e.g., z = 1.91, p > .05 for comparison of correlations between implicit and explicit attitudes toward smoking in the low and high groups). Also, hierarchical regression analyses indicated no significant moderation effect of SDR on the relationship between SR and NSR measures (e.g., ΔR^2 = .01 when examining the moderation effect of SDR on the relationship between implicit and explicit attitudes toward smoking).

Preliminary results for analyses conducted across smoking states found that associations between SDR and explicit attitudes toward smoking were significantly different when participants were abstinent but not trying to quit when compared to the session that they were non-abstinent smoking as usual (t(96) = -2.31, p = .02), suggesting that SDR may be more influential on participant's attitudes toward smoking during moments of abstinence pre-quit as opposed to when smoking as usual prior to quitting. Also, associations between SDR and craving were significantly greater on the quit day when compared to the abstinent pre-quit session (t(89) = -2.48, p = .02), suggesting that SDR may have a greater effect on craving ratings during a quit attempt as opposed to

prior to quitting. While the effect of SDR at different stages in the cessation process has not previously been examined in research, these preliminary analyses indicate that the effect of SDR may vary prior to quitting and during early stages of the quit attempt. However, much more analysis is required to confirm these results (Forde, 2010).

These preliminary analyses lend support to the hypothesis that measures in smoking cessation may be significantly influenced by SDR. However, a more expansive analysis of this issue is needed to fully understand how the effect of SDR may change across different types of measures, different settings, and different motivational states which occur throughout the smoking cessation process. Data available for the current study allowed for examining multiple measures (i.e., self-report and implicit measures across multiple constructs), across two settings (i.e., in the laboratory and outside of the laboratory on a personal digital assistant [PDA]), and across a variety of smoking states during early stages of a quit attempt (i.e., prior to quitting and up to four weeks post-quit attempt). Therefore, a more in-depth and thorough examination of the questions highlighted in the literature review above was possible.

Unique Contribution of Study

The present study builds on the author's preliminary analyses in the following ways. First, whereas the preliminary study examined the associations between SDR and both cognitions and behavior, the current study focused on cognitions. The current study examined associations between BIDR and a wider range of self-report and implicit cognitions than the preliminary study. Second, the present study examined the effect of state in much greater detail. Specifically, additional time points after the participants' quit day were assessed with the hope of clarifying how the effect of SDR varies due to

changes in motivational or situational factors. Third, the study examined the effect of setting. Last, this study had a larger sample size than did the preliminary study.

Rationale

The literature reviewed above highlights the need for additional research in the area of SDR and smoking cessation. While SDR is commonly hypothesized to affect certain types of measures, such as self-reported smoking, mood, and craving (Swanson et al., 2001; Sherman et al., 2003), few studies have directly examined the effect of SDR on different types of measures. To the best of the author's knowledge, only the preliminary analyses presented above have examined these associations within the context of cigarette smoking cessation. In addition, no studies have examined the effect of SDR across different cessation settings (i.e., in the laboratory vs. in the participant's natural environment) or at different stages in the cessation process (i.e., prior to quitting vs. after quit day). It is important to understand the types of measures that might be affected by SDR and how the effect of SDR may be differentially effective at different points during smoking cessation to minimize the effect of SDR on smoking measures and to control for the potential inaccuracy that SDR may create within assessment data. Particularly, it was hypothesized that smokers attempting to quit may have additional motivation to misrepresent responses on smoking measures, so an important aim of the current study was to examine smokers during a quit attempt. The overarching goal of this study was to more fully understand the nature of the effect that SDR may have on assessments in smoking cessation. The specific aims and hypotheses are listed below (see Figure 10).

Specific Aims and Hypotheses

Specific Aim 1: To examine the effect of SDR (BIDR scores) on self-report measures

Hypothesis 1: It was hypothesized that a negative association would be found between BIDR scores and self-report (SR) measures.

Hypothesis 1A: Self-reported attitudes toward smoking (Semantic Differential Scales [SDS]; Swanson et al., 2001): Individuals with higher BIDR scores would report less positive (more negative) attitude ratings.

Hypothesis 1B: Self-reported craving (Questionnaire of Smoking Urges [QSU]; Cox, Tiffany, & Christen, 2001): individuals with higher BIDR scores would report lower craving ratings.

Hypothesis 1C: Self-reported outcome expectancies (Smoking Consequences Questionnaire [SCQ]; Copeland, Brandon, & Quinn, 1995): Individuals with higher BIDR scores would report less positive (more negative) outcome expectancies from smoking.

Specific Aim 2: To examine the effect of SDR (BIDR scores) on implicit measures

Hypothesis 2: Implicit measures are purportedly not within the control of participants, so it was hypothesized that implicit measures would be relatively unaffected by levels of SDR.

Hypothesis 2A: Implicit attitudes toward smoking (Implicit Association Test [IAT]; Greenwald et al., 1998): BIDR scores would not be associated with implicit attitudes toward smoking.

Hypothesis 2B: Attentional bias (Modified Stroop Task [Stroop]; Williams et al., 1996): BIDR scores would not be associated with attentional bias.

Hypothesis 2C: Implicit outcome expectancies (Expectancy Accessibility Task [EA]; Palfai, 2002): BIDR scores would not be associated with implicit outcome expectancies.

Specific Aim 3: To examine the effect of SDR (BIDR scores) on the association between self-report and implicit measures

Hypothesis 3: It was hypothesized that self-report (SR) and implicit measures would be associated and this association would be moderated by BIDR scores.

Hypothesis 3A: Attitudes toward smoking (SDS and IAT): As BIDR scores increase, the association between explicit and implicit attitudes would weaken.

Hypothesis 3B: Craving/Attentional bias (QSU and Stroop): As BIDR scores increase, the association between explicit craving and attentional bias would weaken.

Hypothesis 3C: Outcome expectancies (SCQ and EA): As BIDR scores increase, the association between explicit and implicit outcome expectancies would weaken.

Specific Aim 4: To examine the effect of SDR (BIDR scores) across smoking states

Hypothesis 4: It was hypothesized that the association between BIDR and self-report (SR) measures would vary across smoking states (i.e., abstinent but not trying to quit [AB], non-abstinent and smoking as usual [NON], abstinent while trying to quit on quit day [QD], one week after quit day [WK+1], and four weeks after quit day [WK+4]), but the association between BIDR and implicit measures would not vary across smoking states.

Hypothesis 4A: Attitudes toward smoking (SDS and IAT): the association between BIDR scores and SDS would be 1) higher at the NON session than at the AB

session, and 2) higher at the QD session than the AB session. The assocation between BIDR scores and the IAT effect would not vary across smoking states.

Hypothesis 4B: Craving/Attentional bias (QSU and Stroop): the association between BIDR scores and QSU ratings would be 1) higher at the NON than at the AB session, and 2) higher at the QD session than the AB session. The association between BIDR scores and the Stroop effect would not vary across states.

Hypothesis 4C: Outcome expectancies (SCQ and EA): the association between BIDR scores and SCQ would be 1) higher at the NON session than at the AB session, and 2) higher at the QD session than the AB session. The assocation between BIDR scores and the EA effect would not vary across states.

Specific Aim 5: To examine the effect of SDR (BIDR scores) across settings

Hypothesis 5*:* The association between BIDR and self-report (SR) measures would vary across setting. However, the association between BIDR and implicit measures would not vary across setting.

Hypothesis 5A: Attitudes toward smoking (SDS and PDA SR Attitudes): the association between the BIDR and SR attitudes toward smoking would be stronger in the laboratory than in the field (i.e., assessments given on the personal digital assistant [PDA]).

Hypothesis 5B: Craving (QSU and PDA SR Craving): the association between the BIDR and SR craving would be stronger in the laboratory than in the field.

Hypothesis 5C: Implicit Attitudes toward smoking (IAT): the association between the BIDR and the IAT would not be signficantly different in the laboratory when compared to in the field.

Hypothesis 5D: Attentional bias (Stroop): the association between the BIDR and the Stroop would not be significantly different in the laboratory when compared to in the field.

The primary analyses involved the BIDR total score, because the total score is the score that is most often used in other studies. An exploratory aim of the proposed study was to examine the effects of Impression Management (IM) and Self-Deceptive Enhancement (SDE) scores. It was hypothesized that the IM factor of SDR would have the most influence on the self-report measures used in the current study because the measures do not assess constructs associated with the self, as suggested by previous SDR research. Relatedly, it was hypothesized that SDE would not have a significant effect either due to the lack of ego-based constructs assessed in the present study. Likewise, it was hypothesized that IM would vary the most across time points, because it requires more deliberate effort which should be influenced by cognitive load. Lastly, it was hypothesized that IM would have a greater effect in the laboratory vs. in the field (i.e., PDA assessments), because it would be the most influenced by changes in the level of perceived anonymity.

For the current study, as compared to the preliminary analyses, the author chose not to examine the effect of SDR on measures of smoking behavior (e.g., self-reported smoking rate, salivary cotinine levels, and breath CO levels). The preliminary analyses suggested that self-reported behavior in smoking cessation may not be as susceptible to the effects of SDR, so the focus in the current study was on self-reported and implicit measures of smoking-related cognitions. Likewise, the smoking variable was confounded by the fact that it was directly affected through the study, because

participants were attempting to discontinue their smoking behavior. The other variables of interest, such as craving and attitudes toward smoking, were not directly manipulated through the process of smoking cessation.

Methods

Parent study

The proposed study utilized data collected as part of the parent study "Cognitive Processes in Smoking Cessation" (Principal Investigator: Andrew J. Waters, Ph.D.). The parent study is a longitudinal cohort study designed to examine the association between cognitive measures assessed prior to a quit attempt and outcomes in smoking cessation. It was approved by the Institutional Review Board of The University of Texas M. D. Anderson Cancer Center (MDACC) (see Appendix A) and the Uniformed Services University of the Health Sciences (USUHS) (see Appendix B). Data from both MDACC and USUHS were used in the current study. Description of the parent study, including description of participants, procedure, study design, and measures, is taken from the author's Master's Thesis (Forde, 2010, pp. 16-27).

Participants

Participants included 231 adult, community-based cigarette smokers in the Houston, Texas, and Washington, DC, metropolitan areas recruited via advertisements for smoking cessation treatment. Participants in the Houston, Texas, area were 113 participants assessed in a laboratory at the MD Anderson Cancer Center (MDACC) between February 2007 and August 2008. Participants in the Washington, DC area were 118 participants assessed in a laboratory on the campus of the Uniformed Services University of the Health Sciences (USUHS) between March 2009 and August 2011.

Participants were paid $25 for an orientation session, $50 for each of five laboratory sessions, and $15 for two phone assessments. Participants could also optionally participate in a week-long ancillary study following their quit day in which they completed daily random assessments on a personal digital assistant (PDA). For these assessments, participants received $2.50 for each assessment that they completed. To qualify for the parent study, participants had to be 18-65 years old; be a current smoker with a history of at least 10 cigarettes per day for the last year; be motivated to quit within the next four weeks; have a home address and a functioning home telephone number; be able to speak, read, and write in English at an eighth-grade literacy level; and have English as their first language.

Exclusion criteria included active substance abuse or dependence other than cigarettes; regular use of tobacco products other than cigarettes (e.g., cigars, pipes, smokeless tobacco); use of nicotine replacement products; another household member enrolled in the study; self-reported color-deficiency (due to the necessity to distinguish colored text for the smoking Stroop task); breath carbon monoxide (CO) < 10 ppm (i.e., standard cut-off level indicating regular cigarette use; SRNT, 2002); pregnant or breast feeding; indication of current suicidal ideation or depression, as defined by endorsement of at least "Several Days" for the item assessing suicidal ideation (item 2i) on the Patient Health Questionnaire (PHQ; Spitzer, Kroenke, & Williams, 1999) or endorsement of at least "More than half the days" on at least five of the PHQ items which assess depressive symptoms (2a-h); or any other factor, that, in the judgment of the investigators, would likely preclude completion of the protocol (e.g., a physical limitations that would hinder participant's ability to complete computerized tasks). These criteria are based on prior

research in smoking cessation (e.g., Waters et al., 2007). Participants who reported elevated depressive symptoms were provided with local mental health referrals, and those with active suicidal ideation were referred to the nearest emergency room for evaluation.

Procedure

Participants were first screened via a phone interview in which a tobacco history and demographic information were obtained and it was determined whether they met inclusion/exclusion criteria. Upon preliminary qualification, participants were asked to come in to the laboratory for the orientation session, during which expired breath CO was measured with a CO monitor. Participants completed the following measures to assess qualification for enrollment in the study: the Rapid Estimate of Adult Literacy in Medicine (REALM; Davis et al., 1991); the Shipley Institute in Living Scale (SILS; Shipley, 1940); the Patient Health Questionnaire (PHQ; Spitzer et al., 1999); Section K (Non-alcohol psychoactive substance use disorders) of the Mini International Neuropsychiatric Interview (MINI; Sheehan, et al., 1998); and the Alcohol Use Disorders Identification Test (AUDIT; Saunders, Aasland, Babor, de la Fuente, & Grant, 1993) to assess for alcohol use.

At each of the five sessions, partipants completed a battery of computerized cognitive tasks and questionnaires, including self-report measures and implicit cognitive tasks. Of interest in the current study are the Semantic differential scales (SDS; Swanson et al., 2001), the Questionnaire of Smoking Use (QSU; Cox et al., 2001), smoking expectancy questions taken from the Smoking Consequences Questionnaire (SCQ; Copeland et al., 1995), the Implicit Association Test (IAT; Greenwald et al.,1998), the modified Stroop task (Stroop; Williams et al., 1996), and the Expectancy Accessibility

Task (EA: Palfai, 2002), all of which were administered at each of the laboratory sessions. Self-reported smoking (i.e., a daily smoking diary) and biological measures of smoking (i.e., salivary cotinine and breath CO) were also collected at each of these sessions, but these measures were not analyzed in the current study. SDR, as measured by the Balanced Inventory of Desirable Responding (BIDR; Paulhus, 1988), was given at one of the laboratory sessions. For most of the participants, the BIDR was given at the orientation session.

Sessions consisted of two pre-quit sessions (once when 12-hours abstinent from smoking and once when smoking normally), the quit day, one week after the quit day, and at the end of treatment (four weeks after quit day). In addition, participants had the option of participating in a one week ancillary study which started on their quit day. In this study, participants took a PDA home with them for one week and completed up to four random assessments daily on the PDA. Participants also completed an assessment any time they experienced a temptation to smoke, defined as an occasion when the participant felt an acute increase in the desrie to smoke, or an occasion when they felt they came to the brink of smoking without actually smoking. Assessments on the PDA included a variety of explicit and implicit cognitive tasks. Of interest for the current study are the PDA measures of SR craving, attitudes toward smoking, an implicit measures of attentional bias (i.e., Stroop) and implicit attitudes toward smoking (i.e., IAT) (See Appendix C). Participants also completed an item on the PDA that assessed "difficulty concentrating." Table 3 presents the schedules for laboratory and PDA assessments that were analyzed in the current study. Figure 6 provides an overview of the study design.

Study Design

The order of completion of the implicit assesments and the explicit assessments in the laboratory sessions was counterbalanced across participants. Therefore, half the participants completed the implicit assessments before the explicit measures (for all sessions), and the other half completed the implicit assessments after the explicit assessments. Order of completion of the individual assessments (implicit and explicit) was randomly determined for each participant. Therefore, for example, some participants completed the self-report craving items before the attitude items, and some completed the attitude items before the craving items.

Treatment

Treatment consisted of self-help materials and smoking cessation counseling. All participants received the same treatment.

Self-help materials. Participants received a standardized self-help manual that utilizes a standard relapse prevention/coping skills approach. It is written at a sixth grade reading level (U.S. Department of Health and Human Service, 2000).

Smoking cessation counseling. Counseling was based on standard and recommended smoking cessation/relapse prevention procedures as described in Treating Tobacco Use and Dependence Clinical Practice Guideline (Fiore et al., 2006) and was provided by one of two of the study's licensed, Master's-level counselors. Counseling included: identifying high risk situations; coping with negative affect/stress; weight management; techniques for obtaining social support; coping with a partner/spouse who smokes; keys to success; relaxation techniques; and coping with a lapse. Counselors integrated these topics into an overarching coping skills/problem solving framework that

was guided by each individual's unique barriers and high-risk situations. Counseling sessions lasted approximately 10-20 minutes and occurred during the laboratory sessions.

Pharmacotherapy. Participants were instructed that they should not take any pharmacotherapy during the course of the study and was verified through participant self-report at each laboratory session.

Measures

Orientation measures

The Rapid Assessment of Adult Literacy in Medicine. The REALM is a screening instrument of estimated reading level. It assesses the ability to pronounce 66 common medical words and body parts and takes approximately 2-3 minutes to administer and score. The REALM is highly correlated with other diagnostic literacy instruments and has high validity and reliability, with a test-retest reliability of +.99 (Davis et al., 1991).

The Shipley Institute in Living Scale. The SILS is a widely used measure of estimated intelligence quotient (IQ). As part of the vocabulary test, participants identify words which mean "the same or nearly the same" as a target word. It also contains an abstract thinking test in which participants complete a sentence with an appropriate number or letter. It takes approximately 15-20 minutes to complete and 5 minutes to score (Shipley, 1940). Reliability is high, with coefficients above +.80 (Shipley, 1940), and it has predictive validity with other measures of intelligence (Zachary, Paulson, & Gorsuch, 1985).

The Patient Health Questionnaire. The PHQ is a self-administered diagnostic instrument that assesses mood, anxiety, alcohol, and recent psychosocial stressors using

the diagnostic criteria of the DSM-IV. The PHQ has diagnostic validity and has high levels of agreement with independent diagnoses made by mental health professionals (Spitzer et al., 1999).

The Mini International Neuropsychiatric Interview. The MINI is a self-report measure of psychiatric symptoms. Section K is used to assess non-alcohol drug abuse/dependence. It has good test-retest reliability (kappas of .52 to 1.00 across scales) and interrater reliability (kappas of .79 to 1.00 across scales). It also has strong validity with other structured psychiatric interviews and high levels of agreement with independent diagnoses made by mental health professionals (values of .50 to .90 across scales) (Sheehan et al., 1998).

The Alcohol Use Disorder Identification Test. The AUDIT is a brief questionnaire of alcohol consumption, drinking behavior, and alcohol-related problems. It has high intrascale reliability and correlates strongly with drinking behavior. The AUDIT also has high levels of sensitivity and specificity for detecting problem drinking (Saunders et al., 1993).

The Balanced Inventory of Desirable Responding. The BIDR (see Appendix D) is a 40-item questionnaire that assesses the two factors of socially desirable responding discussed earlier: Impression Management (deliberate self-presentation to an audience; IM) and Self-deceptive Enhancement (the tendency to give self-reports that are honest but positively biased; SDE) (Paulhus, 1988). The BIDR can be scored dichotomously, with one point being given to responses of 6 or 7, or scored continuously in which the raw score is used. Both scoring methods yield an IM score, an SDE score, or a combined total score (TS) of all 40 items. Research suggests that the continuous

scoring system yields higher validity and reliability, as well as convergent validity with other SDR measures (Stober, Dette, & Musch, 2002), however Paulhus (1991) supports use of the dichotomous scoring system as a means of identifying individuals with more extreme levels of SDR. Paulhus (1988) reported coefficient alpha values of internal consistency ranging from .68 to .80 for SDE, .75 to .86 for IM, and .83 for the total score. Test-retest correlations were reported as .69 (SDE) and .65 (IM) over a 5-week period (Paulhus, 1988). Validity correlates reported by Lanyon and Carle (2007) ranged from .30 to .58 and suggest that the scales have moderate divergent validity. In another study, a correlate of .18 was reported, suggesting even stronger divergence (Davies et al., 1998). In a reliability generalization study, Li and Bagger (2007) reported mean reliability estimates of .68 for SDE scores, .74 for IM scores, and .80 for overall scores; these estimates are comparable to those reported for other commonly used social desirability scales (Beretvas, Meyers, & Leite, 2002).

Explicit Cognitive Tasks

Semantic differential scales. The SDS is a measure of self-reported attitudes toward smoking (see Appendix E). The measure consists of six semantic differential items in which polar-opposite adjective pairs are presented to participants. Adjective pairs for the items include positive-negative, good-bad, pleasant-unpleasant, wonderful-terrible, nice-nasty, and part of me-not part of me. Items are rated for the concept of smoking on a 7-point scale, and composite scores (which exhibit good reliability) are calculated by scoring the 7-point scale from -3 to +3 and summing the ratings (Swanson et al., 2001). For the current study, only the first five differential items were used, and scores for this measure were made up of an average of the five items. The last

differential item (i.e., part of me-not part of me) was excluded because it assesses self-identity as a smoker, which varies from the other five items which assess characteristics of smoking. SDS scales are reasonably accurate and have strong associations with other measures that assess the same attitude construct (Heise, 1969).

On the PDA, self-reported attitudes toward smoking were measured at each assessment using a single item (1 to 7 Likert-type scale). It is feasible to assess explicit attitudes on a PDA (Marhe, Franken, & Waters, 2009). In addition, the PDA explicit attitude measure was rescaled to align with the -3 to +3 scale used for the laboratory measure.

The Questionnaire of Smoking Urges. The QSU is a 10-item measure of self-reported craving and was used to assess craving at the time of the test (see Appendix F). The QSU typically provides two factor scores. Factor 1 assesses intention and desire to smoke and anticipation of pleasure from smoking, and Factor 2 is indicative of the participant's anticipation of relief from negative affect and nicotine withdrawal and urgent need to smoke. A total score of the two factors can be computed, and this value was used in the current study (Cox et al., 2001). The QSU is sensitive to abstinence and exposure to smoking-related cues (Morgan, Davies, & Willner, 1999) and has strong internal consistency (alpha of .97 for the total score) (Cox et al., 2001).

On the PDA, craving was measured at each assessment through a single item in which participants responded about whether they were craving cigarettes "right now"; this item was rated on a 7-point Likert-type scale (1 = Strongly Disagree, 7 = Strongly Agree). Craving has been shown to be reliably and feasibly assessed on a PDA (Warthen

& Tiffany, 2009), and numerous studies have demonstrated the utility of single-item measures of craving in EMA studies (Shiffman, 2009).

Smoking Expectancy Questions. Smoking expectancy questions consisted of five items derived from the Smoking Consequences Questionnaire (SCQ; Copeland, Brandon, & Quinn; 1995), a validated questionnaire which assesses positive outcomes from smoking (see Appendix G). Scores on the SCQ have been associated with dependence (Copeland et al., 1995), severity of withdrawal after smoking cessation (Wetter et al., 1994), and outcome in smoking cessation (Copeland et al., 1995). The five items used in this study were: "Smoking now will help me relax"; "Smoking now will energize me"; "A cigarette will taste good now"; "Smoking now will satisfy my cravings"; "Smoking now will help reduce boredom." Participants responded on 11-point Likert-type scales, ranging from 1 = No!! to 11 = Yes!! In a previous study (Waters et al., 2009) responses to the five items were strongly inter-correlated (mean coefficient alpha across 4 sessions = .91, range .87 - .93). An average score was computed to represent positive outcome expectancies from smoking.

Implicit Cognitive Tasks

Implicit Association Test. The IAT is an implicit measure of attitude, as measured through the strength of mental associations between two concepts. It is theorized that substance-related associations in memory are automatically activated in certain conditions (Greenwald et al., 1998). Research suggests that implicit attitudes vary between smokers and non-smokers, as well as between smokers with different levels of nicotine dependence. Smokers with higher levels of nicotine dependence have a less negative implicit attitude toward smoking (weaker association between smoking and

"bad") than smokers with lower levels of nicotine dependence or non-smokers (Swanson et al., 2001; Sherman et al., 2003; Waters et al., 2007). In general, there is substantial support for the validity and reliability of the IAT across multiple constructs, including smoking cessation (Cunningham, Preacher, & Banaji, 2001).

The description of the IAT is taken from previous studies that have utilized the IAT in smoking cessation research (Waters et al., 2010; Waters et al., 2007; Swanson et al., 2001). In the current study, associations between smoking/not smoking and good/bad were examined. The IAT administered in the laboratory consisted of seven blocks: (B1) Practice of categorization for the target (e.g., smoking / not smoking); (B2) Practice of categorization for the attribute (e.g., positive / negative); (B3) Practice of the combined categorization task (Task 1) (e.g., smoking + positive / not smoking + negative); (B4) Critical trials for the Task 1; (B5) Practice of categorization for the target concept but with the response keys reversed from B1 (e.g., not smoking / smoking); (B6) Practice of combined categorization task (Task 2) (e.g. not smoking + positive / smoking + negative); (B7) Critical trials for Task 2. The order of completion of the B3/B4 and B6/B7 was counterbalanced across participants.

Following Swanson et al. (2001), pictures were used to capture the target concepts of smoking vs. not smoking (see Appendix H). For example, a smoking picture depicted cues for smoking (e.g., a table with a packet of cigarettes on it), whereas a not smoking picture depicted the same scene but without the smoking cues (e.g., a table without a packet of cigarettes on it). Words were used for the positive (e.g., nice, pleasant, good) and negative (e.g., nasty, unpleasant, bad) categories (Swanson et al., 2001). On each trial, a stimulus (i.e., a word or picture) was presented in the center of a computer

monitor. On the top right and top left of the screen there were labels to remind the participants of the categories assigned to each key for the particular task they were currently performing. (The labels changed from block to block). Participants performed the task by pressing either the "R" key or the "L" key on a computer keyboard, indicating the selection of either the label on the right or the left. The instructions were to respond as quickly and as accurately as possible.

In B1, B2, and B7, the program selected items at random (without replacement) from the stimulus lists. In B3, B4, B6, and B7, the program selected items at random while alternating trials that presented a smoking or a not smoking picture with trials that presented either a positive or a negative word. After a correct response the program proceeded to the next trial after an inter-trial interval of 150 ms. After an error, then a red "X" appeared below the stimulus and remained on the screen until a correct response was made. The instructions were to correct errors as quickly as possible by pressing the other key.

The scoring algorithm recommended by Greenwald et al. (2003) was applied to derive the IAT effect (Table 4 in Greenwald et al., 2003). Therefore, data from B3, B4, B6, B7 were used to compute the IAT effect. All response times greater than 10,000 msec were eliminated, as this is the standard cut-off used in IAT research (e.g., Greenwald et al., 2003). The algorithm also eliminates assessments on which a participant had response times of less than 300 msec on more than 10% of the trials which would indicate that a participant was not actively engaged in the task. The computed IAT effect, D, is similar to an effect-size measure (Greenwald et al., 2003). The IAT has been shown to have good internal (split-half) reliability of the IAT effect (D

score) in the laboratory (e.g., r = .91 in Waters et al., 2007), as well as in EMA settings (e.g., r = .70 in Waters et al., 2010).

The PDA-version of the IAT consists of four blocks: 1) Task 1-first (e.g., smoking + good/not smoking + bad); 2) Task 1-second; 3) Task 2-first (e.g., not smoking + good/smoking + bad); 4) Task 2-second. The practice blocks provided on the desktop version of the IAT were not included because the participants completed the assessment repeatedly on the PDA. At each assessment, participants were randomly assigned to one of four IATs: a) smoking-good first, good on left; b) smoking-good first, bad on left; c) smoking-bad first, good on left; d) smoking-bad first, bad on left. The same scoring procedures (and positive/negative words) were used for the PDA version that were used for the laboratory version (see Appendix C). However, different pictures were used for the IAT version of the task because some of the pictures in the laboratory version did not work well when re-scaled down to a small size (for use on the PDA). The IAT has been shown to be feasibly and reliably assessed on a PDA. As noted above, the estimated internal reliability of the smoking IAT assessed on the PDA was .70 (Waters et al., 2010).

Modified Stroop Task. The modified Stroop task is an implicit measure of attentional bias (Stroop, 1935). Attentional bias refers to the idea that substance-related cues tend to automatically capture the attention of substance users and may precipitate substance-seeking behavior without the user's conscious awareness (Field, Munafo, & Franken, 2009). Attentional bias to substance-related stimuli in addicts (but not controls) has consistently been demonstrated in research (e.g., Cox et al., 2006; Waters & Leventhal, 2006). It has also been suggested that there may be a reciprocal relationship between attentional bias and craving, such that increased attention to substance cues may

increase subjective levels of craving and that increased craving may increase attentional bias to substance cues (Franken, 2003). Attentional bias and craving have indeed been shown to be related, but this association appears to be moderated by many different variables (Field et al., 2009). One of these moderating variables may be SDR.

Participants completed a modified Stroop task containing ten smoking-related words (e.g., CIGARETTE) and ten neutral words (e.g., FURNITURE). The smoking words were tobacco, cigarette, smoke, craving, urge, ashtray, lighter, puff, drag, and nicotine. The neutral words were drawn from a single semantic category, in this case household features (e.g., sofa, carpet). Following with the literature on the modified Stroop task, each word was presented three times and the assessment consisted of 60 trials total. It took approximately 5 minutes to complete (Gross, Jarvik, & Rosenblatt, 1993). The smoking words and the related neutral words did not differ in length or frequency using the Kucera and Francis (1967) norms.

The description of the smoking Stroop task is taken from previous studies utilizing this assessment in smoking cessation research (e.g., Gross et al., 1993; Munafo et al., 2003). Participants were instructed that words written in different colors (blue, green, or red) would be presented on the screen one at a time and that their task would be to indicate as quickly and as accurately as possible which color the word is written in by pressing the corresponding colored button on the keyboard. Additionally, participants were instructed to ignore the meaning of the word itself and respond only to the color. On each trial, a colored word approximately 6 mm in height was presented in capital letters on the screen and remained there until the participant pressed a button. If the participant made a wrong response, then a tone was sounded. If the participant made no

response within 3 seconds, then the word was removed and a tone was sounded. A new word was then presented 500 ms following the participant's response or 500 ms after the timeout of 3 seconds.

Participants first responded to a practice sequence of 50 trials that consisted of letter strings (e.g., HHHH). They then completed the 60 experimental trials of smoking and neutral words presented in a mixed order. The presentation order of words was randomly determined by the program for each participant under the constraint that the same color did not appear on two consecutive trials. Following with standard protocol for this task (e.g., Gross et al., 1993), reaction times less than 100ms and reaction times for trials on which the participants made an error were eliminated. The Stroop interference effect was derived from the difference in reaction times on smoking vs. neutral words. A Stroop "carry-over" effect was also derived from the difference in reaction times on trials following smoking words vs. trials following neutral words. This carry-over effect is a robust effect and has been proposed to capture the difficulty disengaging attention from smoking words (e.g., Waters, Sayette, & Wertz, 2003; Waters, Sayette, Franken, & Schwartz, 2005) or other drug-related words (e.g., Marissen et al., 2006). In the current study the carry-over effect reflects the difficulty disengaging attention from the smoking word which leads to slower responses on the subsequent trial. The carry-over effect was used as the primary outcome measure of attentional bias in the current study because it had a greater magnitude than the smoking Stroop effect. The smoking Stroop task has been shown to be a reliable and valid assessment of attentional bias (Munafo et al., 2003), and has been shown to be associated with relapse in smokers (Waters et al., 2003). The smoking Stroop task has been shown to have moderate

reliability in laboratory studies (e.g., Waters et al., 2003, reported a split-half reliability of .6).

On the PDA version of the Stroop task, participants responded by pressing one of three response buttons on the PDA corresponding to the three colors (see Appendix C). There were twenty-four lists of words, and a list was randomly selected at each assessment without replacement. The lists contained smoking-related words and matched neutral words and also specified the colors that were used (red-green-blue) and the positions of the colors on the response buttons. The positions varied across lists, so that the task was always somewhat novel to participants. Other aspects of the assessment resembled the desktop version completed in the laboratory. The smoking Stroop task can be assessed on a PDA (Waters & Li, 2008), and the estimated reliability of Stroop indices assessed on the PDA are in the moderate range (.4 to .6).

Expectancy Accessibility Task. The EA is an implicit assessment of outcome expectancies related to smoking which measures reaction times for responses to different smoking expectancies. Outcome expectancies are theorized to come from substance-related memories of use, and it is possible that relapse is triggered by cues that evoke these substance-related expectancies in memory. The description of the EA is taken from previous studies utilizing this assessment in smoking cessation research (Palfai, 2002). Each participant completed two blocks. The first was a control block in which participants responded to varying target words about watching television, and in the second block they had to respond to varying target words about smoking. The targets for the smoking condition were selected to capture both positive and negative outcome expectancies from smoking, so half of the targets reflected positive expectancies and the

other half reflected negative expectancies. Examples of positive outcome expectancies included: Smoking makes me…. i) RELAXED, ii) CALM, iii) HAPPY; Smoking makes me less.... iv) ANXIOUS, v) TENSE, vi) ANGRY. Examples of negative outcome expectancies included: Smoking makes me…. i) ILL, ii) UNHEALTHY, iii) UNATTRACTIVE; Smoking makes me less…. iv) HEALTHY, v) ATTRACTIVE, vi) APPEALING).

On each trial, a priming phrase (e.g., Smoking makes me….) was presented for 1.5 seconds. A target word (e.g., RELAXED) was then presented in capital letters just below the priming phrase, which remained on the screen. Participants were required to endorse the statements as quickly as possible, by pressing a "T" (for true) or "F" (for false) button on the keyboard. There was a 1 second time interval between trials. To increase the pool of trials, two different priming phrases were used in the smoking condition (i.e., Smoking makes me…. and Smoking makes me less….), as well as the control condition (i.e., Watching television makes me…. and Watching television makes me less….). To minimize the potential for confusion, the two different priming phrases for each condition were presented in separate, counterbalanced sub-blocks, and participants were informed of the priming phrase for the next set of trials before each sub-block. Order of presentation of stimuli was randomized within each sub-block.

Within each sub-block, five filler trials were included (e.g., Smoking makes me…. JEALOUS). These target words are not considered to be related to smoking expectancies, so participants were expected to respond "F" to these trials. The inclusion of the filler trials was to ensure that all participants would make a number of "F" responses during the course of each sub-block. Response times on these trials were not

analyzed. Participants also completed a practice block of ten trials which contained statements about their driving; they completed five trials with each priming phase (i.e., Driving makes me…. and Driving makes me less….). These practice trials ensure that the participants understand how to complete the assessment.

Following Palfai (2002), reaction times greater than three standard deviations above the participant mean were excluded from analysis. The EA effect was computed by taking difference scores between the time to endorse smoking expectancies (for "T" responses) minus the time to endorse expectancies for the control activity (i.e., television viewing). Separate scores were calculated for positive and negative outcome expectancies. The focus in this study was on positive outcome expectancies because self-reported outcome expectancies for these outcomes were also available. Measures of expectancy accessibility assessed in the laboratory have been reported to have good internal reliability (Waters et al., 2012).

Data Analysis

General Analytic Strategy. Two analytic strategies were used in the present study. In strategy 1, the BIDR was coded as a categorical variable with two levels to aid interpretation and presentation of the data. Specifically, participants were split based on the median scores into two groups: low BIDR scores and high BIDR scores. This approach made it easier to visualize how the association between explicit and implicit measures varies as a function of SDR level (Figures 3-5). The utility of a tertiary split was considered. To examine the potential utility, a simulation study was conducted that assumed equal-sized groups, normal distribution of the dependent variable in the population, and a linear relationship between the two variables (dependent variable and

BIDR scores) in the population. The results suggested that there is little difference in power between a binary and tertiary split (C. Olsen, personal communication, September 13, 2010). Given that there was likely little to be gained from using a tertiary split (from the perspective of statistical power), a binary split was used.

In strategy 2, BIDR score was treated as a continuous variable. The binary split (Strategy 1), in conjunction with the use of the continuous score (Strategy 2), provided a comprehensive analysis of the data.

To derive the BIDR score, the scoring method as described in Paulhus (1991) was used. Paulhus (1991) recommends using a dichotomous scoring method (i.e., one point being given to responses of 6 or 7), as it is thought to capture only those participants exhibiting more extreme levels of SDR. One study, conducted by Stober et al. (2002) did find higher levels of internal and convergent validity using a continuous scoring method, however most studies examining the BIDR have used the recommended dichotomous scoring system (e.g., Lajunen & Summala, 2003; Rosenfeld et al., 1996; Wilkerson et al., 2002); therefore this system was used in the current study.

For each strategy, the data were examined for both BIDR scale scores, Impression Management (IM) and Self-Deceptive Enhancement (SDE), as well as for the BIDR total score (TS) to evaluate whether the IM and SDE constructs differentially affect the study measures. The emphasis of analyses was on the BIDR TS. However, additional analyses were conducted to elucidate the differential effect of IM and SDE on study measures because, as discussed earlier, IM was expected to affect study measures more than SDE as well as be more sensitive to changes in motivational states and test setting (Paulhus, 1988).

Control Variables. Previous studies have found an association between SDR and demographic variables, such as age, sex, and ethnicity, suggesting potential cultural or cohort effects on SDR rates (e.g., Warnecke et al., 1997). Therefore, demographic variables of age, sex, and ethnicity were examined for an association with BIDR scores. Significant associations were found between BIDR and demographic variables measured in the study (Tables 6-8). There was a significant correlation between gender and the SDE scale of the BIDR ($r(229) = -.14$, $p = .03$), as well as between gender and the IM scale of the BIDR ($r(229) = .13$, $p = .04$). Females tended to have lower SDE scores but higher IM scores. In addition, race was associated with SDE ($r(229) = .24$, $p = .01$) and the BIDR total score ($r(229) = .18$, $p = .01$), such that non-Whites had higher SDR scores. Lastly, there were also significant associations between Site and SDE ($r(229) = .23$, $p = .01$), IM ($r(229) = .13$, $p = .05$), and the total score ($r(229) = .21$, $p = .01$). USUHS participants had higher SDR scores ($M = 16.18$, $SD = 6.28$) than MDACC participants ($M = 13.41$, $SD = 6.64$). Therefore, race, gender, and site (all dichotomous variables) were entered as covariates in all the primary study analyses.

Specific Aims 1 and 2. To address specific aims 1 and 2 (hypotheses 1A-C and 2A-C), a one-way ANCOVA with two groups was used to examine if "low" and "high" BIDR scorers differed on self-report and implicit measures (Strategy 1). This analysis included race, gender, and site as covariates. Pearson's partial correlation coefficient (again, including race, gender, and site as covariates) was used to examine if BIDR scores were correlated with self-report and implicit measures (Strategy 2).

Specific Aim 3. To address specific aim 3 (hypotheses 3A-C), Pearson's partial correlation coefficient was used to examine if self-report and implicit measures were

correlated within the “low” and “high” groups (Strategy 1). In supplemental analyses, the two correlation coefficients (from the two groups) were compared with each other, using the methods described in Howell (2010). This analysis tested the null hypothesis that the partial correlation coefficient in the population for the low BIDR group was equal to the partial correlation coefficient in the population for the high BIDR group. According to Levy & Narula (1978), “Fisher (1924) demonstrated that the distribution of a partial correlation coefficient of order d [adjusted for d other variables] based upon n observations is the same as that of a zero-order or simple correlation based upon (n-d) observations....Thus, all of the methods which are employed to test hypotheses concerning simple correlations can be appropriately employed to test similar hypotheses involving partial correlations." (Levy & Narula, 1978, p. 1). Therefore, the methods described in Howell (2010) were used, but the number of partial variables was subtracted from the sample size.

For strategy 2, hierarchical regression analyses were conducted. The self-report measure served as the dependent (criterion) variable and the implicit measure and BIDR score (scored as a continuous variable) served as predictor variables. The interaction term between the two predictor variables tested whether a moderation effect was present. The interaction term tested whether the regression coefficient, b (or slope), relating the implicit and SR measures was dependent on BIDR scores (coded as a continuous variable). The null hypothesis was that the b value for the interaction was equal to zero in the population. If the null hypothesis was rejected (i.e., there was a significant interaction), then it could be concluded that the relationship (slope) between the implicit and self-report measures was related to BIDR score. This is the preferred method of

moderation analyses in this area of research (see Table 1), and therefore this analysis was chosen to maintain consistency and comparability with the available studies that have examined the moderating role of SDR on the relationship between self-report and implicit measures. In addition, regression analysis has been cited as the most reliable and appropriate method to test for moderation effects (McClelland & Judd, 1993).

For specific aims 1, 2, and 3, each hypothesis was examined for each of the five smoking states: when smoking normally (NON session), when 12-hour abstinent but not trying to quit (AB session), when trying to quit (Quit Day; QD), one week after quit day (WK+1) and four weeks after quit day (WK+4). In addition, each hypothesis was examined for the mean of the five sessions. For each participant, mean scores were computed from data from completed sessions.

Specific Aim 4. To address specific aim 4 (hypotheses 4A-C), two mixed ANOVAs with one between-subjects variable (BIDR group, 2 levels) and one within-subject variable (State, 2 levels: NON vs. AB, or QD vs. AB) were used to examine if low and high BIDR scorers differed on self-report and implicit measures across states (Strategy 1). A significant Group by State interaction on self-reports would reveal that the effect of BIDR on self-reports is moderated by State. For Strategy 2, a general linear model with repeated measures was used (proc glm in SAS). The BIDR score was entered as a (continuous) independent variable. A significant BIDR score by State interaction on self-reports would reveal that the relationship between BIDR scores and self-reports is moderated by State. The BIDR by State interaction term from this analysis was reported in the results. Note that, in the case where the repeated measures variable has two levels,

SAS proc glm yields the same results as SAS proc mixed, if the data are subset to individuals with complete data on the two assessments.

Specific Aim 5. To address specific aim 5 (hypotheses 5A-D), a mixed ANOVA with one between-subject variable (BIDR group, 2 levels) and one within-subject variable (Setting, 2 levels: Laboratory vs. Field) was used to examine if low and high BIDR scorers differed on self-report and implicit measures across settings (Strategy 1). A significant Group by Setting interaction on self-reports would reveal that the effect of BIDR scores on self-reports is moderated by Setting. For Strategy 2, a general linear model with repeated measures was used (proc glm in SAS). The BIDR score was entered as a (continuous) independent variable. A significant BIDR score by Setting interaction on self-reports would reveal that the relationship between BIDR scores and self-reports is moderated by Setting. The BIDR by Setting interaction term from this analysis was reported in the results.

For specific Aim 5, mean data from the QD and WK+1 sessions (that occur before and after the EMA phase) were used to compute a mean score for each subject on the laboratory data. A mean score was computed for each subject from the data collected on the PDA. Therefore, only participants who contribute EMA data were included in these analyses.

Exploratory Aim. As noted earlier, the primary analyses involved the BIDR total score (TS). The same analytic methods listed above were also used for the IM and SDE scores.

Supplementary Analyses on EMA Data. In the EMA data collected, each participant contributed a fairly large number of data points (2442 assessments in total).

To make use of the richness of these data, the association between BIDR scores and self-report measures on EMA were examined using linear mixed models (LMM) analyses (proc mixed in SAS). These analyses were conducted whether or not a significant BIDR score by Setting interaction was revealed. These analyses allowed for the fact that subjects differed in the number of observations available for analysis, and took into account the clustering of data within subjects.

To select an appropriate working correlation structure, Akaike/Schwartz information criteria (AIC/BIC) were used. BIDR scores were entered as a continuous variable. Analyses included the following covariates: study site, gender, race, day in study, number of assessment in day, relapse status at assessment (a categorical variable with three levels: assessment occurred before reported relapse; assessment occurred after reported relapse; timing of assessment unknown with respect to relapse), and assessment type (RA or TA). The timing of assessment with respect to relapse was unknown in the case where a participant did not report smoking on the PDA or on the smoking diaries, but his or her CO level or cotinine levels in saliva at the WK+1 visit revealed that he or she had indeed smoked. In this case, it was known that the participant relapsed but it was not known when he or she relapsed. A main effect of BIDR would reveal that there was an association between BIDR scores and self-report measures and bolster findings from the analyses of aggregated data (using subject means) by demonstrating that an association persisted when controlling for relapse status.

Other Supplementary Analyses. For analyses involving data from post-quit sessions (QD, WK+1, WK+4), there was the additional complication that some participants were abstinent at these sessions and some had relapsed at some point during

the study. In addition, those participants who relapsed had varying rates of smoking. At QD, the majority of participants were abstinent, but at WK+1 and WK+4 the majority of participants were non-abstinent. Abstinence at a given time-point was defined as 1) no self-reported smoking on the PDA or at laboratory visits; 2) breath CO level < 10 ppm; and 3) level of cotinine in saliva < 15 ng/ml (WK+1 and WK+4 outcomes only). All other participants were coded as non-abstinent (relapsed). Of the 176 participants who completed the BIDR and who attended the QD session, 126 (71.6%) were abstinent at QD, 31 (17.6%) were abstinent at WK+1, and 34 (19.3%) were abstinent in the week prior to the WK+4 visit (point prevalence abstinence). None of the BIDR scores were correlated with abstinence at QD, WK+1, or WK+4 (all p values > .22). Therefore, abstinence state at test is unlikely to confound associations between BIDR scores and self-report/implicit measures. Nonetheless, for each case where a significant association between the BIDR total score and an outcome measure was observed on QD, WK+1, or WK+4, the analysis was repeated controlling for abstinence state (a categorical variable with two levels: 0 = abstinent, 1 = non-abstinent). For specific aim 4, participants who were successfully abstinent at the QD session were compared with those who were unable to quit. These groups were not significantly different (no BIDR by abstinence state interaction), so all participants were used in these analyses.

Alpha Level. There was no correction for multiple tests. That is, an alpha level of .05 was used for each test. There were two reasons for this decision. First, adjusting alpha would reduce power to detect real differences in the population and increase the probability of type II errors (i.e., failing to reject a null hypothesis that is in reality false). A reduction in power could not be easily offset by increasing the sample size because the

final sample size was constrained by practical factors (the number of participants who could be recruited in the parent study). Second, to the best of the author's knowledge no investigators in previous studies examining the relationship between self-report, non self-report, and SDR measures adjusted alpha for multiple tests, i.e., these investigators used an alpha level of .05 for each comparison (e.g., Adams et al., 2005; Egloff & Schmukle, 2003; Marissen et al., 2005). Therefore, to maintain consistency and increase comparability with other studies, alpha was not adjusted. This issue is discussed further in the limitations section.

Power Analysis

Power analyses were computed using G*Power Version 3 (Faul, Erdfelder, Lang, & Buchner, 2007). All tests were two-tailed, and alpha was set at .05. The power to detect effects depends on a number of factors including the sample size, which includes both participants from MDACC and USUHS. A power of 80% was used throughout the analyses as an acceptable level of power, based on common practice (Cohen, 1969). The power analyses reported below were based on the expected sample sizes at the time of the proposal defense on 08 December 201. The sample sizes actually available for analysis after the completion of the study were larger than the expected sample sizes, with the final assessment occurring on 23 August 2011. For example, sample sizes ranged from 161 to 208 across the visits (see Table 4), whereas we expected them to range from 141 to 188. Therefore, the power analyses reported below are conservative estimates of power.

For specific aims 1, 2, and 3, if sample sizes range from 141 - 188 across states, using Pearson's r then there is greater than 80% power to detect a correlation in the

population (rho) of (at least) .24 (n = 141) to .21 (n = 188). Using ANOVA, there is greater than 80% power to detect a between-group effect size in the population of d = .42 (n = 141) to d = .37 (n = 188). For specific aim 3, the true difference in magnitude between the population correlations in the Low and High groups would have to be .45 (n = 141) or .40 (n = 188) in order to have power = .80 to reject the null hypothesis that the correlations are equal in the populations. For the regression analysis, for the test of the interaction term there is greater than 80% power to detect a Cohen's f^2 in the population of .06 (n = 188) or .05 (n = 141), which is equivalent to a small to medium effect size.

For specific aim 4, assuming approximately n = 77 in each group, a univariate two-way ANOVA with one between-subjects factor (BIDR Group) and one within-subject factor (State) will have power = .80 to detect a moderate effect size (d = .46) for the between-group difference in between-state difference scores (between-state difference scores are a score in one state minus a score in a second state) (Strategy 2).

For specific aim 5, there was a smaller sample size because not all participants complete the EMA part of the study. In addition, the EMA part of the study was added mid-stream into the study protocol at MDACC. If there are approximately n = 47 in each group, then a univariate two-way ANOVA with one between-subjects factor (BIDR Group) and one within-subject factor (Setting) will have power = .80 to detect a moderate-to-large effect size (d = .59) for the between-group difference in between-setting difference scores (between-setting difference scores are a score in one setting minus a score in a second setting) (Strategy 2).

Results

Baseline and Demographic Variables

Summary statistics for the Balanced Inventory of Desirable Responding (BIDR) are presented in Table 5. Across all eligible participants with BIDR data available (N = 231), the mean BIDR total score was 14.82 (*SD* = 6.60), which is comparable to research averages reported in Paulhus (1991) (total score range of 11.7-16.2). BIDR total scores were dichotomized by median split into a LOW group (0-14) (n = 123, *M* = 9.7, *SD* = 3.3) and a HIGH group (15+) (n = 108, *M* = 20.7, *SD* = 3.9); participants with the median score (14) were assigned to the LOW group. The LOW and HIGH groups did not differ significantly for any of the following baseline variables by BIDR total score (Table 6): age (t(229) = .48, p > .10); gender distribution ($X(1) = .00$, p > .10); breath carbon monoxide (CO) levels at Orientation visit ($t(229) = .91$, p > .10); Fagerstrom Test for Nicotine Dependence (FTND) scores ($t(229) = .45$, p > .10); cigarette smoking rate at orientation ($t(228) = .28$, p > .10). In addition, there was no difference in levels of cotinine in saliva at the non-abstinent (NON) session (t(197) = -.94, p > .10). The LOW and HIGH groups did differ significantly on race distribution (LOW vs. HIGH; 53.2% White vs. 46.8% White; $X(1) = 7.03$, p = .01). In addition, IM scores differed significantly by gender in the LOW and HIGH groups (LOW vs. HIGH; 4.1% Female vs. 49.5% Female; $X(1) = 4.43$, p < .01) (Table 7). SDE scores did not differ significantly on any of the baseline variables.

The MDACC sample (n = 113) and USUHS sample (n = 118) did not differ significantly on age (*M* = 42.8 years, SD = 11.8 vs. *M* = 42.8 years, *SD* = 11.6 ; t(229) = -.01, p > .10), FTND scores (*M* = 5.4, SD = 2.2 vs. *M* = 5.2, *SD* = 1.8 ; t(229) = .91, p >

.10), or cigarette smoking rate at orientation (*M* = 21.0 cigarettes, SD = 9.6 vs. *M* = 19.1 cigarettes, *SD* = 7.8; t(228) = 1.68, p = .09). However, the two samples did differ significantly on gender distribution (50% male vs. 64.1% male; $X(1) = 4.91$, $p < .05$), race distribution (White vs. Non-White; 64.7% White vs. 36.9% White; $X(1) = 18.93$, $p < .001$), breath CO levels at orientation (*M* = 24.2 ppm, SD = 11.4 vs. *M* = 18.8 ppm, *SD* = 9.2; t(229) = 3.89, p < .001), IM scores (*M* = 6.7, SD = 4.0 vs. *M* = 7.8, *SD* = 3.6; t(229) = -2.10, p < .05), SDE scores (*M* = 6.7, SD = 3.6 vs. *M* = 8.4, *SD* = 3.8; t(229) = 3.54, p < .001), and BIDR total scores (*M* = 13.4, SD = 6.6 vs. *M* = 16.2, *SD* = 6.3; t(229) = -3.26, p < .001). As discussed above, gender, race, and site were all entered as a covariate in study analyses due to significant associations with BIDR scale scores.

For the analyses below, the results presented are from all participants from both sites and use the BIDR total score. Analyses of the IM and SDE scores are presented in a later section.

Effect of SDR on Attitudes toward Cigarette Smoking (Hypotheses 1A, 2A, and 3A)

Strategy 1. Table 9 reports analyses conducted concerning the association between BIDR scores, self-reported attitudes toward smoking (as assessed by semantic differential scales; SDS), and implicit attitudes toward smoking (as assessed by the Implicit Association Test; IAT). Results shown represent analyses conducted using the total participant sample (e.g., both sites) and the BIDR total score dichotomized into LOW and HIGH groups (Strategy 1). There were no significant differences found on SDS ratings toward smoking between LOW and HIGH groups (e.g., $F(1, 201) = .62$, $p > .10$ for the mean of the five sessions). There were also no significant between-group (LOW vs. HIGH) differences on the IAT effect (e.g., $F(1, 203) = .96$, $p > .10$ for the

mean of the five sessions). Hypothesis 1A, that BIDR scores would be associated with self-reported attitudes, was not supported. However, BIDR scores were not associated with implicit attitudes which is consistent with Hypothesis 2A.

Over all participants, SDS ratings were correlated with the IAT effect (e.g., r(203) = .24, p < .01 for mean of the five sessions). Correlations between SDS ratings and the IAT effect were found in both the LOW group (e.g., $r(103) = .25$, p < .01 for mean of the five sessions) as well as in the HIGH group (e.g., $r(92) = .25$, p = .02 for the mean of the five sessions). Additional analyses were conducted to determine whether the correlations (between SDS ratings and the IAT effect) in the two groups were significantly different from one another. These analyses test the null hypothesis that the (partial) correlations between SDS ratings and the IAT effect are equal in the two underlying populations (i.e., in the LOW group and the HIGH group). Using a standard critical value of $z = 1.96$ (for a 95% confidence interval), none of the correlations between the LOW and HIGH groups were significantly different (e.g., $z = -1.36$, p > .10 for the mean of the five sessions). These data do not support hypothesis 3A that the association between implicit and explicit attitudes is weaker in individuals with high BIDR scores.

Strategy 2. Hypotheses 1A, 2A, and 3A also were examined with the BIDR total score as a continuous variable (Table 12). Results were broadly similar to those achieved through median split of the BIDR scores. However, there were some differences in findings. When using Strategy 2, there were two significant associations between BIDR and SDS ratings (e.g., $r(191) = -.16$, p = .03 for the NON session, and $r(155) = -.16$, p = .03 for the WK+4 session). However, the correlations for the other states did not reach statistical significance. For the IAT effect, the results were the same as those obtained

using Strategy 1. There was no evidence for any correlation between BIDR scores and the IAT effect. As shown in Table 12, the test of the regression coefficient for the BIDR by IAT interaction term was not significant at any state, thereby providing no support for hypothesis 3A. For example, when the mean SDS rating was the dependent variable, there was no significant increment in explained variance from step 1 to step 2, $\Delta R^2 = .00$, $F(1,198) = .67$. $p > .10$ (IAT x BIDR: $\beta = .012$).

Effect of SDR on Craving for Cigarettes and Attentional Bias (Hypotheses 1B, 2B, and 3B)

Strategy 1. Table 10 reports analyses conducted concerning the association between BIDR scores, self-reported craving (as assessed by the Questionnaire of Smoking Urges; QSU), and attentional bias (as assessed by the Smoking Stroop Task; Stroop). Results shown represent analyses conducted using the total participant sample (e.g., both sites) and the BIDR total score dichotomized into LOW and HIGH groups (Strategy 1). There were many significant between-group (LOW vs. HIGH) differences found for QSU ratings (e.g., $F(1, 201) = 8.35$, $p = .01$ for the mean of the five sessions). This finding supports hypothesis 1B that individuals with higher BIDR scores would report significantly less craving. In fact, all sessions were significantly different with regard to QSU ratings between the LOW and HIGH groups except the AB session and the WK+4 session. Conversely, there were no significant between-group (LOW vs. HIGH) differences on the Stroop effect (e.g., $F(1, 202) = .52$, $p > .10$ for the mean of the five sessions), supporting hypothesis 2B that BIDR scores would not be associated with attentional bias. These findings are illustrated in Figure 11.

Across all participants, QSU ratings were correlated with the Stroop scores (i.e., r(199)=.19, p < .01 for the mean of the five sessions). However, Table 10 reveals that no significant (partial) correlations were found between QSU ratings and the Stroop effect in the LOW group (e.g., $r(103) = .17$, p > .05 for mean of the five sessions). One significant (negative) correlation was found in the HIGH group ($r(77) = -.28$, p = .01 for the quit day session), however correlations were not significant for the other sessions or for the mean of the five sessions. The correlations between QSU ratings and the Stroop effect were significantly different between the LOW and HIGH groups on QD (z = -2.62, p < .01), again using the standard critical value of z = 1.96. This result means that, consistent with hypothesis 3B, the correlation between craving and attentional bias is more negative (less positive) in the HIGH group (Figure 12). However, the correlations were not significantly different from one another in the other states, or for the mean scores. Therefore, these results provide only mixed support for hypothesis 3B that the association between craving and attentional bias is weaker in individuals with high BIDR scores.

Strategy 2. Hypotheses 1B, 2B, and 3B also were examined with the BIDR total score as a continuous variable (Table 13). Results were very similar to those achieved through median split of the BIDR scores (Strategy 1). There were a number of significant correlations between BIDR scores and QSU ratings (e.g., $r(180) = -.24$, p < .01 for mean of the five sessions), thereby supporting hypothesis 1B. In contrast, there were no significant correlations between BIDR scores and the Stroop effect (e.g., $r(180) = .00$, p > .10 for mean of the five sessions), thereby supporting hypothesis 2B. The test of the regression coefficient for the BIDR by Stroop interaction term was significant only

on QD (Table 13), thereby providing only mixed support for hypothesis 3B. For example, when the mean QSU rating was the dependent variable, there was no significant increment in explained variance from step 1 to step 2, $\Delta R^2 = .00$, $F(1,198) = .67$. $p > .10$ (IAT x BIDR: $\beta = .012$).

Effect of SDR on Outcome Expectancies Toward Cigarette Smoking (Hypotheses 1C, 2C, and 3C)

Strategy 1. Table 11 reports analyses conducted concerning the association between BIDR scores, self-reported outcome expectancies (as assessed by items from the Smoking Consequences Questionnaire; SCQ), and implicit outcome expectancies (as assessed by the Expectancy Accessibility task; EA). Results shown represent analyses conducted using the total participant sample (e.g., both sites) and the BIDR total score dichotomized into LOW and HIGH groups (Strategy 1). There was a significant between-group (LOW vs. HIGH) difference found for SCQ ratings (e.g., $F(1, 201) = 12.37$, $p < .01$ for the mean of the five sessions). There were significant differences found for all states expect the AB state. This finding supports hypothesis 1C that BIDR scores would be associated with self-reported outcome expectancies toward cigarette smoking. There were also some significant between-group (LOW vs. HIGH) differences found for the EA effect (e.g., $F(1, 201) = 6.71$, $p = .02$ for the mean of the five sessions). Significant differences were found in AB, QD, and WK+1 sessions. This result failed to support hypothesis 2C that implicit outcome expectancies would not be associated with BIDR scores.

Over all participants, the mean SCQ rating was robustly associated with the mean EA effect ($r(199) = .39$, $p < .01$ for the mean of the five sessions). Table 11 shows that

there were significant correlations between SCQ ratings and the EA effect in both the LOW group (e.g., $r(104) = .30$, $p < .01$ for mean of the five sessions) and the HIGH group (e.g., $r(90) = .43$, $p < .01$ for mean of the five sessions) (Table 11). These results do not appear to support hypothesis 3C that the association between SR and implicit outcome expectancies toward cigarette smoking should be stronger in the LOW group. Additional analyses were conducted to determine whether the correlations (between SCQ ratings and the EA effect) in the two groups were significantly different from one another. Using a standard critical value of $z = 1.96$ (for a 95% confidence interval), none of the correlations between the LOW and HIGH groups were significantly different from one another (e.g., $z = -1.09$, $p > .05$ for the mean of the five sessions). In addition, it should be noted that correlations tended to be larger (rather than smaller) in the HIGH group.

Strategy 2. Hypotheses 1C, 2C, and 3C also were examined with the BIDR total score as a continuous variable (Table 14). Results were very similar to those achieved through median split of the BIDR scores (Strategy 1). There were a number of significant correlations between BIDR scores and SCQ ratings (e.g., $r(201) = -.30$, $p < .01$ for the mean of the five sessions), thereby supporting hypothesis 1C. In contrast, there were also a number of significant correlations between BIDR scores and the EA effect (e.g., $r(201) = -.19$, $p < .01$ for the mean of the five sessions), thereby contradicting hypothesis 2C. The test of the regression coefficient for the BIDR by EA effect interaction term was not significant in any state. For example, when the mean SCQ rating was the dependent variable, there was no significant increment in explained variance from step 1 to step 2, $\Delta R^2 = .00$, $F(1, 197) = .09$, $p > .10$ (EA x BIDR: $\beta = .00$).

This result indicates that the relationship between EA scores and SCQ ratings was not moderated by BIDR scores.

Between-State Differences in Associations (Hypotheses 4A, 4B, and 4C)

Strategy 1 and 2. Additional analyses were conducted to determine if associations between BIDR scores, self-report measures, and implicit measures were significantly different across states. These analyses tested the null hypothesis that the association between BIDR scores and self-report measures were equal in the two states. These results are shown in Table 15 (NON vs. AB) and Table 16 (AB vs. QD).

For the comparison between the NON and AB states, no significant interactions between State and SDR were found whether using Strategy 1 or Strategy 2 (see Figure 13). For the AB vs. QD comparisons, the State by BIDR group interaction was significant for QSU ratings ($F(1, 164) = 3.99$, $p < .05$) and SCQ ratings ($F(1, 164) = 4.81$, $p < .05$) (Table 16). When BIDR scores were examined continuously (Strategy 2), similar results were obtained. There was a significant State by BIDR interaction for QSU ratings ($F(1, 164) = 5.61$, $p < .05$) and SCQ ratings ($F(1, 164) = 6.74$, $p < .05$) (Table 16).

The same analyses were conducted to determine if associations between BIDR scores and implicit measures were significantly different across states. When BIDR scores were split into LOW and HIGH groups (Strategy 1), there was no significant State by BIDR group interaction for any of the comparisons (e.g., $F(1, 175) = .46$, $p > .10$ for IAT, NON vs. AB; $F(1, 164) = .30$, $p > .10$ for IAT, AB vs. QD). Likewise, when BIDR scores were examined continuously (Strategy 2), there were also no significant State by BIDR interaction for any of the comparisons (e.g., $F(1, 175) = .01$, $p > .10$ for IAT, NON vs. AB; $F(1, 164) = 1.12$, $p > .10$ for IAT, AB vs. QD) (Tables 15 and 16). Results for

AB vs. QD comparisons for QSU ratings and the Stroop effect are presented in Figure 14 (Strategy 2).

Between-Setting Differences in Associations (Hypotheses 5A, 5B, 5C and 5D)

Strategy 1 and 2. Mean explicit attitude assessed on the PDA was associated with BIDR scores whether using Strategy 1 (Table 9) or 2 (Table 12). Therefore, BIDR scores were associated with explicit attitudes assessed in the field. The mean IAT effect assessed on the PDA was not associated with BIDR scores.

Mean craving assessed on the PDA was robustly associated with BIDR scores whether using Strategy 1 (Table 10) or Strategy 2 (Table 13). The mean Stroop effect assessed on the PDA was not associated with BIDR scores. This pattern of data is the same as that obtained in the laboratory (Tables 9, 10, 12, and 13). The PDA data for attitudes and craving are illustrated in Figures 15 and 16.

Tables 17 reports analyses conducted for Specific Aim 5, which examined whether the association between BIDR scores and self-report measures is significantly different in the laboratory and on the PDA. There was a significant interaction of Setting and BIDR scores for explicit attitudes when BIDR scores were split into LOW and HIGH groups ($F(1, 102) = 12.08$, $p < .01$) (Strategy 1), as well as when scores were examined continuously ($F(1, 102) = 7.59$, $p = .01$) (Strategy 2). This result suggested that SDR had a significantly stronger effect on self-reported attitudes toward smoking on the PDA than in the laboratory (Figure 17). There were no significant interactions of setting and BIDR for implicit attitudes toward smoking, self-reported craving, or attentional bias for either strategy 1 or 2 (e.g., $F(1, 108) = .18$, $p > .10$ for IAT examined dichotomously; $F(1, 108) = .01$, $p > .10$ for IAT examined continuously). The results for explicit and implicit

attitudes are presented in Figure 17. The non-significant results for self-reported craving and attentional bias are presented in Figure 18.

Differential Effect of IM and SDE on Study Variables (Exploratory Aim)

Overall, results of analyses for Specific Aims 1-3 using IM and SDE scores did not differ markedly from one another (see Appendices I & J). Therefore, the IM and SDE scores were associated with study measures to the same degree as the BIDR total score. This finding ran counter to prediction because it was anticipated that IM would be more strongly correlated with self-report measures than SDE. A few illustrative findings using Strategy 2 are reported below.

SDS Ratings and IAT Effect. For Strategy 2, the correlations between BIDR scores and mean SDS ratings were not significant for IM analyses ($r = -.08$, $p > .10$ for mean of the five sessions) or SDE analyses ($r = -.14$, $p > .10$ for mean of the five sessions). Likewise, the correlations between BIDR scores and mean IAT effect was not significant for IM analyses ($r = -.07$, $p > .10$ for mean of the five sessions) or SDE analyses ($r = -.05$, $p > .10$ for mean of the five sessions). These results were similar for analyses conducted using the BIDR total score.

QSU Ratings and Stroop Effect. For Strategy 2, there were multiple significant correlations between BIDR scores and QSU ratings for IM analyses (e.g., $r = -.19$, $p < .01$ for mean of the five sessions) and SDE analyses (e.g., $r = -.23$, $p < .01$ for mean of the five sessions). Correlations between BIDR scores and the Stroop effect were not significant for IM analyses (e.g., $r = -.03$, $p > .10$ for mean of the five sessions), however, there was one significant correlation between BIDR score and Stroop effect SDE analyses ($r = .17$, $p = .02$ for the NON session).

SCQ Ratings and EA Effect. For Strategy 2, there were a number of significant correlations between BIDR scores and SCQ ratings for IM analyses (e.g., $r = -.27$, $p < .01$ for the mean of the five sessions) as well as for SDE analyses (e.g., $r = -.28$, $p < .01$ for the mean of the five sessions). Additionally, there were also a number of significant correlations between BIDR scores and the EA effect for IM analyses (e.g., $r(201) = -.15$, $p = .03$ for the mean of the five sessions) and for SDE analyses (e.g., $r(201) = -.17$, $p = .01$ for the mean of the five sessions)

Between-State Differences. For Specific Aim 4, examining differences in association between BIDR and study measures between states, results for the IM analyses differed from those results obtained for TS and SDE. No significant interactions were found for IM analyses for self-report measures on the AB vs. QD comparison for Strategy 1 (Appendix I, Table I8). In contrast, SDE (Appendix J, Table J8) analyses revealed significant interactions for both QSU ratings for Strategy 1 ($F(1, 169) = 5.96$, $p = .02$) and Strategy 2 ($F(1, 169) = 5.85$, $p = .02$), as well as for SCQ scores for Strategy 1 ($F(1, 169) = 8.61$, $p < .01$) and Strategy 2 ($F(1, 169) = 8.22$, $p < .01$). Results from SDE analyses were similar to TS analyses (Table 16), which also revealed significant interactions for both QSU ratings for Strategy 1 ($F(1, 169) = 3.99$, $p = .05$) and Strategy 2 ($F(1, 169) = 5.61$, $p = .02$) , as well as for SCQ scores for Strategy 1 ($F(1, 169) = 4.81$, $p = .03$) and Strategy 2 ($F(1, 169) = 6.74$, $p = .01$).

The results of analyses conducted with the IM and SDE scale scores suggest that IM may be less sensitive to changes in state during smoking cessation, which contradicts the hypothesis that IM is a more effortful, and less automatic, aspect of SDR that should be hindered more than SDE by the cognitive effects of acute abstinence. The only

significant interactions found for implicit measures was for SDE and the Stroop effect for the NON vs. AB comparison for Strategy 2 ($F(1, 96) = 5.61$, $p < .05$) (Appendix J, Table J7), SDE and the Stroop effect for the AB vs. QD comparison for Strategy 2 ($F(1, 96) = 5.61$, $p < .05$) (Appendix J, Table J7), and SDE and the EA effect for the AB vs. QD comparison for Strategy 2 ($F(1, 96) = 4.80$, $p < .05$) (Appendix J, Table J8).

Between-Setting Differences. For Specific Aim 5, examining differences between settings, results did not differ at all among IM, SDE, and TS analyses.

Supplementary Analyses on EMA data

Linear mixed models conducted on assessment-level EMA data gave similar results to those reported earlier for the subject-level EMA data (Tables 12 and 13). When controlling for study site, gender, race, day in study, number of assessment in day, relapse status at assessment, and assessment type, the BIDR score was associated with explicit attitude (Parameter Estimate = -.05, SE = .02, $p < .05$) and self-reported craving (Parameter Estimate = -.09, SE = .02, $p < .001$), but not with the IAT effect (Parameter Estimate = .00, SE = .01, $p > .8$) or the Stroop effect (Parameter Estimate = -.56, SE = .56 , $p > .3$).

Supplementary Analyses on data from QD, WK+1, WK+4

All the reported associations between the BIDR total score and self-reported outcomes reported in Tables 9-14 persisted when controlling for abstinence state at time of test.

Discussion

A primary aim of this study was to examine the effect of socially desirable responding (SDR), as measured by the Balanced Inventory of Desirable Responding (BIDR), on self-report (SR) and implicit measures in cigarette smoking cessation (Specific Aims 1 and 2). These aims were examined in the laboratory, on PDAs in the participants' natural environment, and also across different time points in the cessation process. The data indicated that participants with higher SDR scores reported lower craving ratings (in the laboratory and field) and less positive outcomes expectancies than did participants with lower SDR scores. Participants with higher SDR scores reported less positive attitudes to smoking in the field.

In contrast, attentional bias and implicit attitudes were not associated with SDR in the laboratory or the field. Other primary aims examined whether or not SDR moderated the relationship between self-report and implicit measures (Specific Aim 3), and whether the association between SDR and self-report measures differed across states (Specific Aim 4) and settings (Specific Aim 5). Overall, the data revealed that there was limited evidence that SDR scores moderated the association between self-report measures and implicit measures. The effect of SDR on self-reported craving and outcome expectancies was larger on the quit-day than on the pre-quit abstinence session. For self-reported attitudes, the effect of SDR was larger in the field than in the laboratory assessments. A summary of the outcomes for each of the primary hypotheses is provided in Table 18. Each of these results is discussed in more detail below.

Effect of SDR on Self-report and Implicit Measures

With one notable exception (discussed later), self-report measures were generally associated with SDR in the expected direction, such that individuals with higher BIDR scores reported significantly lower levels of self-reported craving and more positive self-reported outcome expectancies than did participants with lower BIDR scores. One of the most interesting and robust findings was results from the craving analyses. This finding of lower reported craving for high BIDR participants was observed in the laboratory setting (using the QSU) and in the field setting (using a single item of craving). So, individuals who scored highly on the BIDR consistently reported lower craving ratings. The effect size was small-to-moderate in the laboratory and moderate-to-large in the field.

However, consistent with study hypotheses, the same high BIDR individuals did not exhibit a more negative (less positive) Stroop effect either in the laboratory or in the field. Confidence in these findings is increased by the fact that they were consistent across the two analytic strategies (i.e., they were observed when BIDR score was coded as a dichotomous variable and as a continuous variable). In addition, LOW and HIGH groups did not differ on biological measures of nicotine use (i.e., breath CO at orientation and levels of cotinine in saliva at the non-abstinent visit) or level of nicotine dependence (i.e., FTND scores). These data suggest that individuals with higher BIDR scores smoked at about the same rate as individuals with lower BIDR scores, and that they are similarly addicted to nicotine. Therefore, they should presumably be experiencing similar levels of craving. **Overall, this finding suggests that craving in smoking**

cessation may be sensitive to social desirability bias and that an implicit measure related to craving (i.e., Stroop effect) may be less sensitive to this bias.

To the best of the author's knowledge, the current study is the first study to comprehensively examine the association between social desirability bias and craving during a smoking cessation attempt. However, it is interesting to note that, in other contexts, researchers have reported significant negative associations between social desirability bias and craving. For example, Wasan et al. (2009) reported a robust association between social desirability bias (assessed with the Marlow-Crowne Social Desirability Scale) and craving for prescription opioid medication in 613 chronic pain patients. The effect size ($r = -.22$) was of a comparable magnitude to that reported here. In the Wasan et al. study, social desirability bias was one of the strongest predictors of craving which, in turn, was associated with subsequent medication misuse. Wilson et al. (2012) reported that, in 57 smokers, social desirability bias assessed with the BIDR was significantly (negatively) associated with craving ratings taken during exposure to a cigarette smoking cue ($r = -.37$). The authors did not report whether BIDR score was associated with craving during exposure to a neutral cue. Participants in the Wilson et al. (2012) study may have been especially motivated to under-report their craving because they were instructed to engage in a coping strategy (either self-focused or other-focused) during cue exposure. In a laboratory cue exposure study, Conklin et al. (2008) reported that there was a significant negative association between the impression management scale of the BIDR and craving during cue exposure to smoking pictures in 62 smokers ($r = -.37$). Interestingly, no other significant correlations between the BIDR IM score and other self-report measures were found.

The association between social desirability bias and self-reported attitude to smoking was less robust than that between social desirability bias and craving. Hypothesis 1A, that BIDR scores would be associated with self-reported attitudes, received only weak support in the laboratory setting. The two BIDR groups did not differ on any of the laboratory sessions (Strategy 1). When BIDR score was used as a continuous variable (Strategy 2), a significant association between SDR and self-reported attitudes was only observed at two sessions. It is unclear why this association was less strong than that obtained for self-reported craving. It is possible that the range of scores on this measure was too small, with many of the scores clustered around the minimum score. This floor effect presumably reduced the variability in self-reported attitude ratings and may have diminished the possibility for detecting a significant difference between groups. It is also possible that participants did not feel pressured to present their attitudes towards smoking in a socially desirable manner during the course of a smoking cessation study, instead potentially feeling more inclined to report their attitudes more honestly because the researchers were fully aware of their heavy smoking status.

Interestingly, BIDR scores were significantly negatively associated with self-reported attitudes measured in the field. Self-reported attitudes assessed in the field were more positive and had greater variability than attitudes assessed in the laboratory, and this feature of the data may have made it easier to detect a correlation in the field. This point is discussed in more detail later. **BIDR score was not associated with the IAT effect, which confirmed Hypothesis 2A and supports the notion that implicit measures may not be susceptible to the effects of social desirability.**

Self-reported outcome expectancies were associated with social desirability in the expected direction. Individuals with higher BIDR scores tended to give less positive outcome expectancies. This result supports hypothesis 1C. An interesting, and unexpected, finding was that the BIDR score was also negatively associated with implicit expectancies toward smoking, with some significant associations found when BIDR was scored as a dichotomous (Strategy 1) and as a continuous (Strategy 2) variable. Implicit measures were hypothesized to be less susceptible to the effects of social desirability than self-report measures. While results were generally consistent with this conceptualization in the study, expectancy accessibility did show an association with BIDR scores. The EA task may be more susceptible to SDR effects because reaction times on this task are slower than reaction times on the Stroop task and the IAT, meaning that there is more opportunity for conscious processing to influence task performance. Moreover, in their review of implicit tasks that use reaction time data, Houben, Wiers, and Roefs (2006) argued that accessibility measures are probably more closely related to self-report measures than are other reaction time assessments, such as the IAT. Because the EA task requires respondents to report directly on their cognition, the purpose of the assessment may be more obvious to the participant. In the IAT, for example, participants do not directly report on their cognitions. Rather, participants perform a categorization task. In this sense, the IAT (and Stroop task) are considered indirect measures. Stated another way, it is more likely that participants could provide socially desirable responses on the EA task because the purpose of the task (assessing outcome expectancies) is more evident to them and because they have more time to "edit" their responses.

Effect of SDR on the Association Between Self-report and Implicit Measures

It was hypothesized that the association between self-report and implicit measures would be weaker in participants with higher BIDR scores. When the BIDR score was analyzed dichotomously, with BIDR scores split into LOW and HIGH groups (Strategy 1), with one exception the BIDR score did not appear to moderate the relationship between SR and implicit measures for attitudes, craving, or outcome expectancies. It was expected that associations between self-report and implicit measures would be consistently stronger in the LOW group, but this result was not seen in the data. Notably, significant correlations in the expected direction were generally found between self-report and implicit measures.

However, the correlations were, with one exception, not significantly different between the LOW and HIGH groups. The exception was that the association between QSU ratings and the Stroop effect was significantly different in the two groups on the quit day session. This result is difficult to interpret for two reasons. First, it was the sole significant difference observed. Second, the correlation, although positive, was not significant in the LOW group, and there was an unexpected (significant) negative correlation in the HIGH group (Figure 12). It is difficult to understand why there would be a negative correlation between self-reported craving and the Stroop effect in the HIGH group, unless individuals who exhibited more positive Stroop effects manipulated their craving responses more than did other individuals. This possibility had not been anticipated (Figures 3-5).

Similarly, using regression analysis (Strategy 2), and with one exception, there was no evidence that social desirability bias moderates the relationship between the

implicit and self-report measures. The regression analysis tests whether the slope between the implicit and self-report measures varies by the level of BIDR scores. As noted above for Strategy 1, the exception was that the association between QSU ratings and the Stroop effect was significantly moderated by BIDR scores on the quit day session.

In sum, there is only weak evidence that the association between implicit and self-report measures was moderated by SDR. In terms of craving and attentional bias, and with the exception noted earlier, the data most closely followed the schema shown in Figure 3. For self-reported attitudes and implicit attitudes, the data again most closely follow the schema shown in Figure 3, except that the effect of social desirability bias on self-reported attitudes was significant only under limited conditions. In general, high SDR participants tended to report lower self-report ratings, particularly for craving, but there is little evidence that the correlation between implicit and self-report measures was lower for these participants.

There are several explanations for why a clear-cut moderation effect may not have been detected in this study. It has been suggested that statistically significant interactions may be difficult to detect in moderation analyses because of lower levels of statistical power, particularly when conducting non-experimental field studies using non-manipulated variables (McClelland & Judd, 1993). However, previous studies which have examined this moderation hypothesis have similarly been unable to detect robust moderation effects when assessed using multiple regression analysis. It may simply be that there is, in fact, no moderation effect (of social desirability bias) on the relationship between self-report and implicit measures. Rather, the main influence of social

desirability bias may be simply to reduce scores on self-report measures in susceptible individuals. Notably, the current data are similar to those of Marissen et al. (2005), which also reported that social desirability bias was associated with self-reported craving but did not moderate the association between self-reported craving and physiological responses to drug cues. Another possibility is that there may be other unidentified variables that may moderate this relationship more robustly. Future research may help to clarify the exact role that social desirability bias plays on the relationship between self-report and implicit measures.

Between-State Differences in Associations

As discussed previously, social desirability bias may be important in all stages of smoking cessation. It is, therefore, important to understand the effect of social desirability bias both prior to quitting and at the early stages of a quit attempt. However, the effect of SDR at different stages in the cessation process has not previously been examined in research. These data suggest that the effect of SDR may vary prior to quitting and during early stages of the quit attempt. These analyses suggest that the association between SDR and self-reported craving was significantly stronger on the quit day session when compared to the 12 hour abstinent session. In addition, it was noteworthy that, over all participants, significantly lower levels of craving were reported at the quit day session than on the 12 hour abstinent session. Although there are other possible explanations (e.g., participants may report lower levels of craving on quit-day because they perceive smoking to be unavailable, e.g., Wertz & Sayette, 2001), it is possible that the SDR was partly responsible for the generally low levels of craving on quit day.

Likewise, the association between SDR and self-reported outcome expectancies was significantly stronger on the quit day session when compared with the 12 hour abstinent session with significantly less positive outcome expectancies reported at quit day. These results suggest that individuals may be more inclined to misrepresent self-reported information at the outset of a quit attempt, although in the current study this did not hold true for self-reported attitudes assessed in the laboratory. Again, a floor effect may have made it difficult to detect an effect of SDR on self-reported attitudes assessed on quit day.

Although it had been hypothesized that the cognitive effects of acute abstinence may affect the operation of the social desirability bias, none of the NON vs. AB comparisons produced significant interaction effects. However, many of the comparisons were in the expected direction. For example, a significant effect of BIDR was observed on QSU ratings at the NON session but not at the AB session. Therefore, the null effect for the BIDR by State interaction should be treated with caution. These points notwithstanding, it is possible that SDR may operate less effortfully and more automatically than previously thought and, therefore, may not be affected significantly by changes in cognitive processing capabilities during the smoking cessation process. There were no significant interactions (State x BIDR) found when implicit measures were analyzed, suggesting that implicit measures are not as susceptible as self-report measures to changes in state. Therefore, implicit measures may provide more reliable and valid data particularly on the quit day. It may be most useful to utilize implicit assessments once individuals have quit because they may be more motivated to mis-represent reported information related to their smoking at that point (and especially on the quit day).

Between-Setting Differences in Associations

As noted above, results of between-setting analyses were particularly interesting given the hypothesis that measures given outside of the laboratory on the PDA would not be as susceptible to the effects of SDR as measures given in the laboratory. The only effect of setting found in the current study was a significant interaction between setting and BIDR for self-reported attitudes. The association between BIDR scores and self-reported attitudes was stronger for PDA data than for laboratory data. This result is contrary to prediction. Consistent with predictions, there were no between-setting differences found for implicit attitudes.

The results of analyses conducted with attitudes toward smoking suggest that data regarding self-reported attitudes may be more valid (e.g., less susceptible to SDR) when gathered in the laboratory. It is unclear why self-reported attitudes on the PDA would be more prone to the effects of social desirability. Perhaps this result is because of the effects of PDA measures taken during the acute stages of smoking cessation. Additional research is needed to clarify why this result ran contrary to expectation. One possible explanation for the pattern of data is that self-reported attitudes were generally more positive (less negative) when assessed on the PDA compared to in the laboratory, as illustrated by a large main effect of Setting (Table 17). There may have been less of a floor effect in the PDA data than in the laboratory data, making it easier to detect an association. For example, the mean score on the self-reported attitude scale of low BIDR participants was -2.04 (on a -3 to +3 scale). Low BIDR individuals reported very negative attitudes, so there was little room for high BIDR individuals to report even more negative attitudes. In addition, low BIDR individuals reported a mean score of -2.39 at

the QD session. In contrast, low BIDR individuals reported a score of 3.04 on the PDA attitude measure (on a 1 to 7 scale), so there was more room for high BIDR individuals to report a more negative attitude.

For self-reported and implicit craving measures, there were no differences between settings. It is unclear why self-reported craving did not show the same effect as self-reported attitudes between the laboratory and the PDA. Earlier results indicated that self-reported craving did vary significantly between LOW and HIGH groups, suggesting that individuals higher in SDR were possibly providing inaccurate information regarding the level of their self-reported craving. It is possible, then, that these individuals were equally motivated to misrepresent this information in both the laboratory and on the PDA, thereby potentially obscuring any differences between settings.

It should be noted that, due to method factors, there are complications in interpreting the data from the between-setting comparisons. Different self-report measures were used in the laboratory and on the PDA, with different number of items as well as different measurement scales. For example, the 10-item QSU (0 – 10 scale) was used to assess craving in the lab, whereas a single item (1-7 scale) assessed craving on the PDA. Also, six semantic differential scales (-3 to +3 scale) were used to assess self-reported attitudes in the laboratory, whereas a single item (1-7 scale) assessed self-reported attitudes on the PDA. Although the PDA measure of explicit attitudes was rescaled for these analyses to align more closely with the attitude scale given in the laboratory, it was still difficult for a direct comparison between the other measures. Also, there were differences in the implicit assessments administered in the laboratory and on the PDA. F or practical reasons relating to the size of the PDA screen, different pictures

were used for the IAT in the two settings. Also, participants completed practice blocks at each IAT laboratory assessment, but practice assessments were not used on the PDA version. Different blocking types were used with the Stroop assessed in the lab and field. These considerations constrain the interpretations that can be made from these analyses.

However, the significant results for self-reported attitudes found in the current study do suggest that future work should examine the question of setting effects of SDR more specifically. As noted earlier, it is possible that attitude ratings of all participants (low and high BIDR) are boosted in the field because the richer environment elicits psychological responses that make cigarettes seem more attractive (e.g., during temptations to smoke). The low BIDR participants may accurately report these more positive attitudes on the PDA, whereas the high BIDR participants report more negative attitudes. If it is accurate that SDR has a stronger effect on self-report measures assessed outside the laboratory, then this is an important finding. EMA is a growing research field right now, with nearly all researchers emphasizing the increased validity (i.e., decreased effect from demand characteristic and response biases) obtained by assessing individuals in their natural environments. If this is, in fact, not the case, then it is even more important that additional research is conducted to confirm how valid EMA measures are compared to laboratory measures.

Differential Effect of IM and SDE on Study Variables

Interestingly, there were very few differences found between analyses using the IM and SDE scores of the BIDR. Therefore, the SDE scale appeared to be associated with self-report measures as well as the IM scale. The starting point of this investigation was that SDR is mainly a “system 2” bias. For example, when people complete

questionnaires they consciously manipulate or "edit" their responses so as to give a socially desired response in the particular context. Put another way, individuals need to "think a little" before making a socially desirable response so that it is not an automatic response. However, the data seem to suggest that SDE is just as important as IM. Therefore, SDR may also function as a system 1 bias.

Many cognitive biases, including "optimism bias," are system 1 biases (Kahneman, 2011), suggesting two possibilities. The SDE component of SDR may be a side effect of another bias, such as optimism bias. According to Kahneman (2011), individuals generally have an overly positive view of themselves, and this view of themselves is more positive than others' views of them. This positive bias is illustrated by strong associations in automatic semantic memory (system 1) between "me" and positive attributes, such as "good," "strong," and "successful." Therefore, individuals' automatic associations concerning themselves are overly positive. It was initially thought that these automatic positive associations relating to the self should not influence automatic associations with non "self-related" stimuli, such as attitudes for cigarettes or craving for cigarettes. However, if an individual interprets the question "are you craving a cigarette?" as "are you struggling?", or "are you having a bad time?", or even "are you weak?", then it is possible that the automatic positivity bias may produce a lower rating than is warranted. According to this view, the SDE component of SDR is related to an automatic positivity bias. In this way SDE may conceivably influence responses in the context of smoking cessation.

Alternatively, SDR may initially be an exclusively system 2 bias but, over time, it becomes automatized (mediated by system 1). Although individuals may initially need

to “think things through” before providing a socially desirable response, with practice some may become skilled at producing socially desirable responses on questionnaires without invoking this extra thinking (system 2). According to this view, the SDE component of SDR may become an "expertise effect," and expertise is mediated by system 1.

In sum, in many contexts SDR may involve both automatic (system 1) and controlled (system 2) components. However, it is still unclear how IM and SDE may operate differently with regard to self-report and implicit measures in smoking cessation, as well as how they may operate differently across varying states and settings. The examination of differences between IM and SDE was only an exploratory aim of the current study and the study was not designed specifically to address this question. Therefore, further research, designed specifically with this question in mind, needs to be conducted to fully understand how these two factors may operate differently.

Implications

The findings of this study have both theoretical and clinical implications. Theoretically, the most important implication of the study is as follows. A common assumption among researchers working in the implicit cognition and addiction field is that implicit measures are less susceptible to the socially desirability bias than are self-report measures. Although this assumption has been stated in numerous articles, little empirical data have directly tested this assumption. To the best of the author’s knowledge, the current study is one of the first studies, if not the first, to provide direct empirical support that some implicit assessments are indeed less sensitive to SDR bias than are self-report assessments in the addictions.

In particular, the data suggest that craving ratings may be more valid in low SDR participants. This finding is particularly important because craving measures are widely used as an assessment in cigarette smoking, and other addiction, research. Craving ratings are important predictors of relapse in smoking cessation (Waters et al., 2004). There are some contexts in which drug addicts report low levels of craving (e.g., abstinent alcoholics). For example, a number of researchers who have used EMA to study relapse in alcoholics have commented on the low levels of craving in this population (Shiffman, 2009). In addition, in smoking cessation research, Shiffman et al. (1997) reported that craving ratings are generally low post-quit at random assessments. In the current study, craving ratings were low on quit day. One may wonder whether the low reports of craving in the contexts above are at least in part the result of SDR effects.

These results suggest that researchers should assess and control for the effect of SDR if possible, something that has rarely been done in past research. The need to assess and control for SDR is likely to apply in other clinical domains as well, in which individuals would be motivated to misrepresent self-report information. If SDR is assessed, then it can be tested as a moderator variable. For example, craving ratings may be a better predictor of relapse among individuals low in SDR than among individuals high in SDR. Given the results of the present study, this hypothesis may be especially true for craving ratings on the quit day. Note, however, that the evidence for a moderating role in the current study was weak. However, it is possible the SDR serves as a moderator variable for relapse.

If SDR is assessed, then it could also function as a suppressor variable. A suppressor variable is defined as a predictor variable which does not measure variance in

the criterion variable but does measure some of the variance in the independent variable that is not found in the dependent variable. In this way, the suppressor variable suppresses the invalid variance and makes the independent variable a better predictor of the dependent variable (Horst, 1966). Even if SDR is uncorrelated with a dependent variable, such as relapse, it can increase the association between a predictor variable (e.g., craving) with which it is correlated and an outcome (e.g., relapse). The basic idea is that SDR adds addiction-irrelevant variance to the predictor variable, and accounting for SDR "cleanses" the predictor of this irrelevant variance. Therefore, at a minimum, assessing SDR allows researchers to test SDR in this role.

The results of this study also suggest that increased use of implicit assessments may be particularly useful in individuals high in SDR. It may be potentially useful for those individuals low and high in SDR to receive different assessments to maximize the utility of data obtained through assessment measures. For example, self-report data may be more useful in low SDR participants than in high SDR participants. In addition, future research examining the relationship between implicit and explicit cognition to risk of relapse should consider the role of SDR and control for its effect on assessment data.

The same ideas listed above may apply to other areas of health and clinical psychology in which self-report data are collected, particularly for the growing number of research areas where EMA is used. That is, SDR could be assessed in other contexts and tested as a moderator or suppressor variable. Self-report data may be more useful in low SDR participants, and implicit assessments may be particularly useful in high SDR individuals. Inclusion of SDR measures may allow researchers to make better predictions of smoking cessation outcomes and other health behaviors. By designing

studies in this manner, researchers may be able to better predict which individuals are likely to struggle with smoking cessation and other health behavior changes, and such individuals could be given more extensive treatment. Implicit measures may be especially useful in the assessment of trauma, where individuals may be motivated to under-report their level of distress.

It is also possible that tailoring the way self-report information is gathered could be helpful in additionally controlling the degree of SDR. Richman, Kiesler, Weisband, and Drasgow (1999) conducted a meta-analysis to examine the effect of SDR across different types of assessment administration, including computer-administered questionnaires, traditional questionnaires, and interviews. They found that individuals appeared less likely to distort their responses on computer-administered questionnaires than in face-to-face assessments, particularly when anonymity was stressed. The Richman et al. (1999) study suggests that administration method should be considered, particularly for individuals higher in SDR who may be more prone to misrepresent information, and that providing anonymity and less face-to-face time during assessments may be beneficial to help control the effect of SDR on self-report data. However, it is not clear how the Richman et al. (1999) findings apply to EMA methodology, and the current study suggests that data collected using EMA are, if anything, more susceptible to SDR than are data collected in the laboratory.

Limitations

There were several limitations of the present study that should be noted. There was attrition over time in the study leading to different sample sizes at each session. Non-random attrition may have led to subtly different subsections of the sample at

different states which may complicate direct between-state comparisons. However, this concern does not affect the NON vs. AB and AB vs. QD comparisons because these analyses were restricted to those participants who completed both sessions.

Similarly, the degree of practice on the assessments is confounded with state (e.g., the QD session is always the third session), so this design may also complicate direct between-state comparisons. This limitation does not apply to the NON vs. AB comparison because the order of completion of these two states was counterbalanced across participants. However, it does potentially apply to the AB vs. QD comparison because State is confounded with order (all participants complete the AB condition before the QD condition).

As noted earlier, for the between-setting comparisons the interpretation of the data is complicated by the fact that, for practical reasons, the same measures were not used on the PDA as in the laboratory (e.g., the IAT presented in the laboratory always used practice blocks, whereas practice blocks were not used on the PDA version). Therefore, between-setting differences in the associations between BIDR scores and self-reported craving/attitudes may reflect method factors in addition to, or instead of, the effect of setting. In addition, the PDA part of the study was added mid-stream into the study, meaning that it is was not completed by all participants. Participants could decline to take part in the PDA study, and so the participants who volunteered to complete the PDA study were a self-selected sample. This aspect of the study design may limit the generalizability of the findings from the PDA study.

The current study did not examine relapse as an outcome variable. While analyses examining the relationship between SDR and relapse (as an outcome) should be

examined in future research, it was beyond the scope of the proposed study to examine this variable. However, these analyses are a priority for future research. In particular, as noted earlier, it will be interesting to determine if the association between self-report measures and cessation outcome is stronger in participants low in SDR.

Data were also collected from two study sites, the MD Anderson Cancer Center (MDACC) and the Uniformed Services University of the Health Sciences (USUHS). Differences in the settings (e.g., a cancer center vs. a military university setting) may lead to subtly different patterns of association in the two sites. Between-site comparisons were beyond the scope of the current study, but could be examined in future research. Because site was associated with SDR, this variable was included as a covariate in analyses. However, we did not report results of BIDR by Site interaction tests, which would examine whether associations involving BIDR were different at the two sites

There was no control for multiple tests. Given the large number of tests (approximately 300 for BIDR total score analyses), the family-wise error rate was obviously elevated. One could anticipate that 5% of these analyses could result in Type I significant results (approximately 15 significant results) if all null hypotheses were in reality true. However, analyses conducted in this study revealed over 60 significant results, so it is unlikely that even the majority of these significant findings were the result of type I errors. Likewise, as was the case with the preliminary analyses, the pattern of results was fairly consistent across the two different analytic strategies used (Strategy 1 and 2), and, at least for Specific Aims 1 and 2, the results also tended to be conceptually consistent (i.e., consistent with hypotheses). The overall pattern of results, together with their analytic and conceptual consistency, suggests that the findings were not due

primarily to type I errors. MANCOVA analyses were considered, in order to decrease the overall number of necessary tests. However, one of the primary goals of this study was to examine how SDR might operate differently across the multiple time points (i.e., smoking states) in this study, so MANCOVA analyses did not provide the opportunity to examine the study measures at this level.

Another limitation concerns the hypotheses in which there is a prediction of an interaction or where there is a test of the difference in magnitude between two independent correlations (e.g., hypothesis 3). It has been suggested that statistically significant interactions may be difficult to detect due to (relatively) lower levels of statistical power, particularly when conducting non-experimental field studies using non-manipulated variables (McClelland & Judd, 1993). Similarly, large sample sizes are often required to detect significant differences between two correlation coefficients (Howell, 2010). Hypothesis 3, concerning the moderation effect of SDR, was generally not supported. This result is consistent with other literature on the moderation effect. It is possible that sample sizes for the current study were not large enough to detect this moderation effect. It is also possible that SDR may not be a significant moderator in the relationship between SR and implicit measures, as previously hypothesized.

A broad limitation of the study, which is shared by all research on SDR, is that the study was limited by the use of an SDR questionnaire to assess SDR. When an individual endorses 1 or 2 (Not true) for the item “I sometimes tell lies if I have to” the idea is that that this is a socially desirable response because everybody does indeed lie from time to time. But individuals clearly differ in their propensity to lie. Imagine a smoking nun enrolling in the study who might in fact (truthfully) respond 1 or 2 to this

question. In this example, the nun might be classified as being high in SDR when in fact she was reporting the truth. Measures of SDR cannot account for real individual differences in the positive traits involved in the assessment of SDR, and so responses presumably reflect both real differences in these traits (e.g., honesty) and SDR. In this sense, the questionnaire measure of SDR is, at best, an impure measure of SDR.

Finally, and related to some previous points, another broad limitation of the study is that the parent study was not designed with the role of the BIDR in mind. In fact, the BIDR measure was added mid-stream into the study. If the parent study had been designed with the role of the BIDR in mind, then additional assessments may have been included in the assessment battery. For example, it may have been useful to include an implicit measures of self-esteem (e.g., an IAT measure involving the categories of me/not me and good/bad). SDE scores might be predicted to be strongly associated with this measure because SDE is thought to tap automatic positive associations related to the self. Further research needs to be conducted specifically with the two factors of SDR in mind to further clarify how they affect measures differently, as well as how they might operate differently between settings and states.

Strengths

Despite these limitations, the study had some notable strengths. Most importantly, this study is only the second study, with the author's preliminary analyses discussed earlier, to assess SDR and a battery of self-report and implicit assessments in a smoking cessation context. In addition, it was the first study to examine the differential effect of SDR across different settings (laboratory vs. field settings) and also across the cigarette smoking cessation process. The study also had a fairly large sample size. In

sum, the study may be the most comprehensive evaluation of the role of SDR on self-report and implicit assessments conducted in the addictions literature to date. Although there is much future research that needs to be done to fully understand the role of SDR on measures in smoking cessation, this study provides a useful foundation for research moving forward.

Future Directions

As noted earlier, for the current dataset a priority for future research is to examine whether associations between self-report measures and relapse is stronger in individuals with lower BIDR scores. Understanding this relationship may aid in increasing researchers' ability to accurately assess risk of relapse and predict relapse.

As discussed previously, the BIDR can be scored using a continuous scoring method (continuous in the sense that individual items on the BIDR are not dichotomized but rather retained as numbers of a 1-7 scale, and not in the sense that the total score is a continuous variable) in addition to the dichotomous scoring (used in this study). Little research has examined the difference between these two scoring algorithms. However one study does suggest increased reliability and convergence with other SDR measures using the continuous scoring method (Stober et al., 2002). Therefore, it may be useful to examine differences in the results obtained with the continuous scoring method.

Also, little research has examined the IM, SDE, and BIDR total score separately to assess how these different constructs of SDR may affect assessment data differently. Therefore, further research must be conducted with the specific goal of understanding how these two factors operate. The results of the study suggest that SDR has both

automatic (system 1) and controlled (system 2) attributes. Further research is required to understand the cognitive bases of SDR.

As noted previously, gender was analyzed as a covariate in all analyses due to the significant correlation between gender and BIDR scores. In this study, females tended to have lower SDE scores but higher IM scores. Likewise, the two sites (i.e., MDACC and USUHS) differed significantly in gender distribution. Since gender was included as a covariate, these differences were not of overwhelming concern in the analyses conducted for the current study. However, it is important to note as a future research direction because of the importance of gender as a variable in tobacco and cigarette smoking research. Previous research has suggested that gender is an important variable in all stages of cigarette smoking, including initiation (e.g., Hamilton et al., 2006), maintenance (Perkins, Donny, & Caggiula, 1999), and cessation (e.g., Wetter et al., 1999). Likewise, it has been indicated as a significant moderator variable in the relationship between explicit and implicit measures across multiple constructs (e.g., Egloff & Schmuckle, 2003; Riketta, 2005). There is also some research suggesting that gender is an important variable in socially desirable responding (e.g., Becker & Cherny, 1994). This highlighted research suggests that gender is an important variable in smoking cessation research and socially desirable responding, as well as research examining potential moderators of the explicit-implicit relationship. It is important for future research to continue to examine the role that gender may play in each of these separate fields of research, but also the effect of gender when these research areas are examined together, as in the current study.

Lastly, this study provided some evidence that SDR may operate differently in different settings. This finding has been shown in a handful of previous studies as well.

It will be important for future research to more adequately examine if the relationship between SDR and SR/implicit measures vary across settings. If it is shown that the effects of SDR can be minimized in certain settings, then this information could be useful to decide when and how self-report information is obtained from individuals to get the most reliable and valid data. Also, if it is true that SDR has a greater effect on EMA data than on laboratory data, then this finding has important implications for research using EMA. Therefore, examining the effect of SDR in EMA studies should be a priority for future research.

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Table 1

Summary of Literature on Associations Between Socially Desirable Responding (SDR) and Self-report/Non Self-report Measures

Study	N	SDR Measure	SR measure	Correlation (r) of SDR with SR measure	NSR measure	Correlation (r) of SDR with NSR measure	Moderation effect	Notes
Rohsenow et al. (1992) Study 2	60 alcoholic males in first week of detox 28 alcoholic males in 4th week of inpatient VA tx	MCSD	Cue-provoked craving (urge to drink)	-.07 (ns)	Change in physiologic response (salivation)	**-.19***		Significant correlation between SDR and outcome variable lost when ADS scores were added as a covariate
Rohsenow et al. (1992) Study 3	34 alcoholics in first week of inpatient VA tx	MCSD	Cue-provoked craving (urge to drink)	-.12 (ns)	Change in physiologic response (salivation)	-.09 (ns)		
Egloff & Schmuckle (2003) Exp.1	145 students	SDS-17R	Self-reported anxiety (STAI)	-.01 (ns)	Anxiety IAT	-.05 (ns)	$\Delta R^2 = .003$ (ns)	
Egloff & Schmuckle (2003) Exp. 2	62 students	BIDR (IM, SDE)	Self-reported anxiety (STAI & IAT-e)	**SDE & STAI: -46**** **SDE & IAT-e: -.36* (p<.01)**	Anxiety IAT	SDE & IAT: -.14 (ns) IM & IAT: .16 (ns)	STAI : IAT x SDE: $\Delta R^2 = .001$ (ns)	

				IM & STAI: .09 (ns) IM & IAT-e: .09 (ns)			IAT x IM: $\Delta R^2 = .007$ (ns) IAT-e: IAT x SDE: $\Delta R^2 = .00$ (ns) IAT x IM: $\Delta R^2 = .008$ (ns)	
Adams et al. (2005)	81 participants	MCSD	PAEE assessed by PAR (7 day PAR 1, 7 day PAR 2, 24 hour PAR) Duration of Light, Mod, Vigorous activity assessed by PAR	7 day PAEE assessed by PAR 1: .12 (ns) 7 day PAEE assessed by PAR 2: .21 (ns) 24 hour PAEE assessed by PAR: .06 (ns) (Correlations between MCSD and reported durations not reported)	PAEE assessed from doubly labeled water Duration of Light, Mod, Vigorous activity assessed by Actigraph	PAEE assessed from doubly labeled water: -.02 (ns) (Correlation between MCSD and activity durations recorded by Actigraph not reported)		Difference score between PAEE assessed by PAR minus PAEE assessed by doubly labeled water[1] 7 day PAR 2: B=.65 (CI: .06, 1.25) Difference score between activity duration assessed by PAR minus activity duration assessed by Actigraph[1] 7 day PAR 2

								and Light activity: B=11.30 (CI: 1.87, 2.73); 7 day PAR 1 and Moderate activity: B=4.81 (CI: .90, 8.73); 7 day PAR 2 and Moderate activity: B=4.15 (CI: .10, 8.21)
Hofmann, Gschwendner, & Schmitt Study 1 (2005)	93 undergrad students	MCSDS	Trait rating scale for East and West Germans ATEG	Trait rating = **-.27*** ATEG = -.01	IAT of West and East Germans	.01	Trait rating : IAT x SD: ΔR^2 = .000 (ns) ATEG: IAT x SD: ΔR^2 = .012 (ns)	
Marissen et al. (2005)	76 heroin-dependent participants in inpatient substance abuse tx	Lie scale (EPQ-RSS)	Cue provoked craving (ΔVAS, OCDUS–TI, OCDUS–DC, ΔDDQ-DI)	OCDUS-TI:-.20 (ns) **OCDUS-DC: -.29**** **ΔVAS: -.25*** **ΔDDQ-DI: -.26***	Change in physiologic response (ΔSCL, ΔSCR)	ΔSCL: .11 (ns) ΔSCR: -.11 (ns)	OCDUS-DC x ΔSCR: ΔR^2 = .01 (ns)	

Nosek (2005)	6836 volunteers (had to complete at least 1 task; 12,563 tasks completed)	Self-presentation (assessed by mean of internal, external, and average person's motivation to respond without negativity)	57 object pairs rated by warmth of feelings toward object: 1 (cold) to 9 (very warm) Object categories: social groups; political issues; pop culture, products, and things; states and actions; and ideas	Not reported	IAT for each explicit object pair	Not reported	**Between-objects: B = -.39, SE B = .19, t = -2.12, p = .03, d = .04 Between-persons: B = -.11, SE B = .03, t = -2.96, p = .003, d = .06**	External motivation (of the 3 factors of self-presentation) was the only significant predictor in the moderation analyses when the 3 factors were analyzed together 3 other variables (evaluative strength, dimensionality, and distinctiveness) showed evidence of moderation effect on relationship
Riketta (2005)	99 German university students	BIDR (IM, SDE)	Self-Liking Self-Competence Scale (SLSCS)	SLSCS and IM: .01 **SLSCS and SDE: .45****	Name-Letter Technique (N-L) Self-Esteem IAT	N-L and IM: .17 N-L and SDE: .07 IAT and IM: .08	N-L x IM: B = .15, SE = .09, p = .10 IAT x IM: B = .01, SE = .12,	SDE moderated the implicit-explicit relationship for 2 of the implicit measures

Initials- Preference (I-P)	IAT and SDE: .15 I-P and IM: .17 I-P and SDE: .15	p = .91 I-P x IM: B = .15, SE = .10, p = .12 N-L x SDE: B = -.07, SE = .08, p = .40 **IAT x SDE: B = -.24, SE = .10, p = .03** **I-P x SDE: B = .20, SE = .09, p = .02**	independent of gender (another known moderator of this relationship)

Table Note: Only studies in which a socially desirable responding (SDR) measure was administered are included (see text for details). The moderation effect (assessed using multiple regression analysis) tested whether SDR moderates the association between the self-report measures and the outcome variable. SR = Self-report measure (Use or Cognition); NSR = Non Self-report measure (Use or Cognition); MCSD = Marlowe-Crowne Social Desirability Scale; SDS-17R = Revised Social Desirability Scale-17; BIDR = Balanced Inventory of Desirable Responding (IM = Impression management; SDE = Self-deception enhancement); EPQ-RSS = Eysenck Personality Questionnaire Revised Short Scale; STAI = State-Trait Anxiety Inventory; IAT = Implicit Association Test; IAT-e = Explicit rating of the IAT stimuli; PAR = Physical Activity Report; VAS = visual analog scale; OCDUS-TI = Thoughts and Interference subscale of the Obsessive-Compulsive Drug Use Scale; OCDUS-DC = Desire and Control subscale of the Obsessive-Compulsive Drug Use Scale; DDQ-DI =Desire and Intention subscale of the Desire for Drug Questionnaire; PAEE = physical activity energy expenditure; SCL = skin conductance level; SCR = skin conductance responses; ADS = Alcohol Dependency Scale; Δ = change scores; ATEG = Attitudes Toward East Germans; BSPS = Blatant and Subtle Prejudice Scale

[1]Reported B values derive from regression analysis in which the difference score is the dependent variable and Social Desirability and Social Approval are the independent variables. *p < .05; ** p < .01, **p < .001 (Significant effects are bolded)

Table 2

Summary of Literature on Differences in Social Desirable Responding (SDR) and Explicit Measures Across Settings and Administration Modes

Study	N	Primary IV of Admin Mode	Second IV of Admin Mode	SDR Measure	SR Measure	Main Effect of Primary IV (F unless otherwise noted)	Main Effect of Second IV (F)	Differences on SR measure across settings	Notes
Paulhus (1984)	100 undergrad students	Anonymity (Anon; Identified)		SDQ ODQ MMPI-L WSDS ESDS MCSDS		ODQ: **3.25*** MMPI-L: **3.21*** WSDS: **2.64*** MCSDS: **2.35***			Interaction of condition and test type (IM vs. SDE) was significant (F = 12.48**); IM scales affected more significantly by anonymity than SDE
Lautenschlager & Flaherty (1990)	241 undergrad students	Admin Mode (Computer without backtracking; Group Paper and Pencil; Individual Paper and Pencil)	Anonymity (Anon; Identified	BIDR v6 (SDE and IM)		**SDE: 14.82** **IM: 3.32***	**SDE: 6.02*** **IM: 5.35***		
Booth-Kewley, Edwards, &	246 male Navy recruits	Admin Mode (Computer with	Anonymity (Anon; Identified	BIDR v6 (SDE and IM)	OCQ	SDE: .33 IM: .12	SDE: **7.25*** IM: **3.76*** (identified	Organizational Commitment did not differ	Similar trends obtained with dichotomous

Rosenfeld (1992)		backtracking; Computer without backtracking; Paper and pencil)					participants presented selves more favorably)	significantly across groups (specific values not reported)	scoring but main effect of anonymity level did not reach significance
Rosenfeld, Booth-Kewley, Edwards, &Thomas (1996)	247 male Navy recruits	Admin Mode (Paper and pencil; Computer-nonlinked; Computer linked)	Anonymity (Anon; Identified)	BIDR v6 (SDE and IM)	GPA	Not significant (specific values not reported)	Multivariate : **3.57*** IM: **7.12**** (Identified participants had significantly higher IM scores)	No difference between groups	
Rosse et al. (1998)	197 job applicants and 73 job incumbents	Context (Job application; Job incumbent)		BIDR v6 (IM scale only) scoring system not specified	NEO-PI	t = **7.6**** (job applicants reported significantly higher IM scores)		Job applicants had significantly higher scores on positive traits (E, C, and A) and significantly lower on negative traits (Neuroticism) with average effect size = .65	Applicants with high levels of IM significantly more likely to be hired based on reported levels of C (IM levels 1-2 SD above the mean)
Fox & Schwartz (2002)	200 Israeli military students	Perceived Control (Fair control; Weakened control;	Anonymity (Anon; Identified)	BIDR v6 MCSDS	TN Self-Concept Scale (trust and candor)	Multivariate : **2.87**** BIDR-IM: **5.32**** (higher	1.43	No significant differences between groups	Secondary analyses comparing computer and paper-pencil

		Choice; Prior familiarity of stimuli and responses)				levels of perceived control led to higher levels of IM)			admin found significantly higher IM scores in paper-pencil admin
Wilkerson, Nagao, & Martin (2002)	85 undergrad students	Context (Job screening interview; Consumer survey)	Admin Mode (Computer; Paper and pencil)	MCSDS BIDR v6 (IM scale only)	SR GPA and SAT scores	Multivariate : **26.40**** (V = .40) MCSDS: **5.32**** BIDR-IM: **3.31**** (participants in job screening interview presented selves more favorably)	No significant results (specific values not reported)	Over-reporting of GPA and SAT scores in job screening interview condition, but not significant (specific values not reported)	
Lajunen & Summala (2003)	47 Finnish applicants for a driving instructor training course and 54 first-year students in course	Anonymity (Anon; Identified)		BIDR v6 (SDE and IM)	DBQ	**SDE: .34** **IM: 8.90**** (identified participants presented selves more favorably)		Anon participants reported undesirable behaviors significantly more often on 6 of 27 DBQ items; no effect when controlling for IM scores	No difference between successful and non-successful applicants on any analyses

Tooze et al. (2003)	484 participants	Admin Mode (Written measure; Interview measure; Physiologic measure)		MCSDS	Energy Intake		MCSDS scores predictive of underreporting of energy intake in face-to-face interview but not SR energy intake measure	
Risko, Quilty, & Oakman (2006)	120 Canadian undergrad students and 284 self-selected web participants	Admin Mode (Paper and pencil; Web)		BIDR v3 (SD-E, SD-D, and IMP scales) MCSDS EPQR-L		SD-E: **12.53**** (comparing student web and self-selected web participants; self-selected web reported lower SD-E scores)		Students were randomly assigned to 2 admin modes No difference between admin modes when controlling for the sample
Gannon, Keown, & Polaschek (2007)	41 child molesters	Admin Context (BP; Control)	Time (1 and 2)		MOLEST scale		**9.52**** (sig. higher MOLEST scores in BP group) **2.53**** (sig. higher MOLEST scores in at time 2) **9.52**** (BP group had sig. higher	Assessed at baseline then randomized into groups and assessed again; 18 in BPL group and 23 in Control group) Questionnaire read to

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				MOLEST scores at time 2 when compared to time 1 and Control group for 24 of 38 items)	participant by experimenter and verbal responses were recorded by experimenter on computer
Kreuter, Presser, & Tourangeau (2008)	1501 University of Maryland Alumni	Admin Mode 1) CATI 2) IVR 3) Web	Measure of desirable and un-desirable academic events	Marginally sig. diff. between 3 modes in for undesirable items ($p<.07$; F-value not reported); sig. diff. between CATI and Web ($p<.02$; F-value not reported)	Sig. higher rate of misreporting in CATI group when comparing SR information to information available through the university

Table Note: SDQ = Self-Deception Questionnaire; ODQ = Other-Deception Questionnaire; MMPI-L: Minnesota Multiphasic Personality Inventory-Lie Scale; WSDS = Wiggins Social Desirability Scale; ESDS = Edwards Social Desirability Scale; MCSDS = Marlowe-Crowne Social Desirability Scale; SDR = Socially Desirable Responding; BIDR = Balanced Inventory of Desirable Responding (versions 3 and 6); SDE = Self-Deceptive Enhancement; IM = Impression Management; SD-E = Self-Deceptive Enhancement; SD-D = Self-Deceptive Denial; IMP = Impression Management; OCQ = Organizational Commitment Questionnaire; GPA = Grade Point Average; EPQR-L = Eysenck Personality Questionnaire Revised – Lie Scale; NEO-PI-R: NEO Personality Inventory-Revised; SR = Self-report; DBQ = Driving Behavior Questionnaire; CATI = Computer Assisted Telephone interview; IVR = Interactive Voice Recognition; BP: Bogus Pipe Line (use of a fake lie detector); * $p < .05$ **$p < .01$ **$p < .001$

Table 3

Summary of Study Procedures

	Orientation (Lab)	WK-2 (Lab)	WK-1 (Lab)	QD (Lab)	Days 1-7 (EMA)	WK+1 (Lab)	WK+4 (Lab)
Implicit Assessments							
IAT		X	X	X^5	X^5	X^5	X
Stroop		X	X	X^5	X^5	X^5	X
EA		X	X	X		X	X
Self-report Assessments							
Semantic differential scale		X	X	X^5		X^5	X
QSU		X	X	X^5		X^5	X
SCQ		X	X	X		X	X
BIDR	X						
PDA Craving					X^5		
PDA Attitude					X^5		

Table Note: IAT = Implicit Association Test; Stroop = Modified Smoking Stroop Task; EA = Expectancy Accessibility Task; QSU = Questionnaire of Smoking Urges (10 items); SCQ = Smoking Consequences Questionnaire (5 items); BIDR = Balanced Inventory of Desirable Responding (40 items); PDA Craving = Craving item administered on PDA; PDA Attitude = Attitude item administered on PDA; WK-2 = two weeks prior to participants' quit day; WK-1 = one week prior to participants' quit day; QD = participants' quit day; EMA = ecological momentary assessment data provided via measures on a personal digital assistant (PDA) for one week following participants' quit day; WK+1 = one week following participants' quit day; WK+4 = four weeks following participants' quit day; X^5 = assessments involved in comparison of effects in Lab vs. EMA (Aim 5). Note: Order of completion of explicit and implicit measures was counterbalanced across participants. The order of completion of individual laboratory assessments (explicit and implicit) was randomly determined for each participant.

Table 4

Sample Sizes for Participants with Balanced Inventory of Desirable Responding (BIDR) Scores

	Orientation (signed ICD)	WK-2 (Lab)	WK-1 (Lab)	QD (Lab)	Provided EMA data	WK+1 (Lab)	WK+4 (Lab)
MDACC							
Total	150	138	125	116	57	111	99
w/ BIDR data	113	105	98	92	54	91	83
USUHS							
Total	118	103	88	84	63	79	78
w/ BIDR data	118	103	88	84	63	79	78
ALL							
Total	268	241	213	200	120	190	177
w/ BIDR data	**231**	**208**	**186**	**176**	**117**	**170**	**161**

Table Note: MDACC = Participants assessed at MD Anderson Cancer Center (Houston, Texas); USUHS = Participants assessed at the Uniformed Services University of the Health Sciences (Bethesda, Maryland); BIDR = Balanced Inventory of Desirable Responding; WK-2 = two weeks prior to participants' quit day; WK-1 = one week prior to participants' quit day; QD = participants' quit day; EMA = ecological momentary assessment data provided via measures on a personal digital assistant (PDA) for one week following participants' quit day; WK+1 = one week following participants' quit day; WK+4 = four weeks following participants' quit day

Table 5

Summary Statistics for the Balanced Inventory of Desirable Responding (BIDR) for Participants Included in Analyses

		MDACC (n = 113)	USUHS (n = 118)	ALL (N = 231)
SDE	Mean (SD)	6.67 (3.61)	8.45 (3.81)	7.58 (3.81)
	Median	6	8	7
	Range	0-16	1-20	0-20
	Alpha	.72	.68	.72
IM	Mean (SD)	6.73 (3.97)	7.73 (3.57)	7.24 (3.80)
	Median	6	8	7
	Range	0-16	0-16	0-16
	Alpha	.80	.72	.77
TS	Mean (SD)	13.41 (6.64)	16.18 (6.28)	14.82 (6.59)
	Median	12	16	14
	Range	1-28	13-32	1-32
	Alpha	.84	.78	.82

Table Note: MDACC = Participants assessed at MD Anderson Cancer Center (Houston, Texas); USUHS = Participants assessed at the Uniformed Services University of the Health Sciences (Bethesda, Maryland); SDE = Self-Deceptive Enhancement scale of the BIDR; IM = Impression Management scale of the BIDR; TS = Total score of the BIDR (total of all 40 items)

Table 6

Association between BIDR scores and Baseline Variables

	Low BIDR (Total) N= 123	High BIDR (Total) N= 108	Correlation of BIDR (Total) with Baseline Variable
Age (years)	43.8 (12.3)	43.0 (1.9)	.01
Gender (% Female)	46.3	42.6	-.01
Race (% Non-White)	**39.3**	**56.5**	**.18****
Cigarettes per Day	19.8 (8.09)	19.5 (8.49)	-.05
FTND scores (0 - 10)	5.30 (2.10)	5.19 (2.02)	-.05
CO Orientation (ppm)	21.6 (1.5)	2.4 (9.51)	-.00
Cotinine in Saliva (ng/ml)	384.7 (225.3)	415.3 (23.8)	.07

Table Note: BIDR = Balanced Inventory of Desirable Responding (Total Score); FTND = Fagerstrom Test for Nicotine Dependence; CO Orientation = Carbon Monoxide level at the Orientation session. Data are mean (SD) or percent. Correlations are Pearson's r. Cotinine in saliva was assessed at the non-abstinent session

* $p < .05$ **$p < .01$

Table 7

Association between Impression Management (IM) scores and Baseline Variables

	Low IM N= 122	High IM N= 109	Correlation of IM with Baseline Variable
Age (years)	42.8 (11.8)	44.1 (11.5)	.09
Gender (% Female)	4.1	49.5	**.13***
Race (% Non-White)	43.4	51.4	.08
Cigarettes per Day	19.6 (8.3)	19.7 (8.3)	.04
FTND scores (0 - 10)	5.3 (2.0)	5.3 (2.1)	.02
CO Orientation (ppm)	21.5 (1.4)	2.5 (9.7)	.05
Cotinine in Saliva (ng/ml)	389.5 (219.3)	41.5 (238.0)	-.04

Table Note: IM = Impression Management scale of the Balanced Inventory of Desirable Responding; FTND = Fagerstrom Test for Nicotine Dependence; CO Orientation = Carbon Monoxide level at the Orientation session. Data are mean (SD) or percent. Correlations are Pearson's r. Cotinine in saliva was assessed at the non-abstinent session * $p < .05$

Table 8

Association between Self-Deceptive Enhancement (SDE) scores and Baseline Variables

	Low SDE N= 119	High SDE N= 112	Correlation of SDE with Baseline Variable
Age (years)	44.4 (12.0)	41.4 (11.2)	-.07
Gender (% Female)	53.8	34.8	**-.14***
Race (% Non-White)	38.7	56.3	**-.24****
Cigarettes per Day	19.9 (8.1)	19.5 (8.5)	-.05
FTND scores (0 - 10)	5.4 (2.2)	5.1 (1.9)	-.10
CO Orientation (ppm)	21.4 (1.2)	2.7 (9.9)	.07
Cotinine in Saliva (ng/ml)	404.7 (234.2)	394.1 (222.8)	-.04

Table Note: SDE = Self-Deceptive Enhancement scale of the Balanced Inventory of Desirable Responding; FTND = Fagerstrom Test for Nicotine Dependence; CO Orientation = Carbon Monoxide level at the Orientation session. Data are mean (SD) or percent. Correlations are Pearson's r. Cotinine in saliva was assessed at the non-abstinent session * $p < .05$ ** $p < .01$

Table 9

Differences in Explicit and Implicit Attitudes Toward Smoking for Low and High BIDR Participants (Strategy 1)

	Self-Report	Low BIDR M (SD)	High BIDR M (SD)	ANCOVA Low and High BIDR (F value)	Implicit	Low BIDR M (SD)	High BIDR M (SD)	ANCOVA Low and High BIDR (F value)	Partial Correlation between SR and Implicit (r) Low BIDR	Partial Correlation between SR and Implicit (r) High BIDR
NON	SDS	-1.74 (1.04)	-1.94 (1.12)	2.11	IAT effect	-.91 (.52)	-.93 (.50)	.59	.02	**.22***
AB	SDS	-1.79 (1.10)	-1.79 (1.18)	.04	IAT effect	-.80 (.54)	-.83 (.56)	1.07	**.21***	.17
QD	SDS	-2.39 (.84)	-2.28 (1.10)	.22	IAT effect	-.74 (.56)	-.79 (.54)	1.46	.17	**.28****
PDA	PDA Attitude	3.04 (1.42)	2.47 (1.39)	**3.99***	PDA IAT effect	-.32 (.43)	-.27 (.37)	.52	.12	.14
WK+1	SDS	-2.39 (.77)	-2.33 (1.09)	.08	IAT effect	-.57 (.53)	-.59 (.52)	.72	.13	**.28***
WK+4	SDS	-2.38 (.80)	-2.45 (.98)	.24	IAT effect	-.73 (.51)	-.58 (.52)	.96	**.27***	**.29***
Mean	SDS	-2.04 (.79)	-2.10 (.99)	.62	IAT effect	-.74 (.45)	-.76 (.47)	.96	**.25****	**.25***

Table Note: Hypotheses 1A, 2A, and 3A. BIDR = Balanced Inventory of Desirable Responding; NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = participants' quit day; PDA = assessments given on a personal digital assistant for one week following quit day; WK+1 = one week following quit day; WK+4 = four weeks following quit day; Mean = Mean of 5 laboratory sessions; IAT = Implicit Association Test; SDS = Semantic Differentiation Scales (-3 to +3); PDA Attitude (1 to 7); Ns vary from 199 (NON) to 152 (WK+4); N = 107 for PDA analyses; degrees of freedom for ANCOVA analyses = NON (1, 194), AB (1, 194), QD (1, 169), WK+1 (1, 164) and WK+4 (1, 147); *p<.05, **p<.01

Table 10

Differences in Craving and Attentional Bias Toward Smoking Cues for Low and High BIDR Participants (Strategy 1)

	Self-Report	Low BIDR M (SD)	High BIDR M (SD)	ANCOVA Low and High BIDR (F value)	Implicit	Low BIDR M (SD)	High BIDR M (SD)	ANCOVA Low and High BIDR (F value)	Partial Correlation between SR and Implicit (r) Low BIDR	Partial Correlation between SR and Implicit (r) High BIDR
NON	QSU	3.98 (2.58)	3.02 (2.50)	**6.80****	Stroop effect	26.67 (75.20)	35.31 (98.40)	.88	.07	-.06
AB	QSU	6.12 (2.22)	5.81 (2.48)	1.10	Stroop effect	37.35 (92.28)	26.70 (83.17)	1.06	.14	.03
QD	QSU	3.68 (2.27)	2.73 (2.38)	**7.63****	Stroop effect	15.62 (79.50)	16.34 (6.26)	.01	.12	**-.28****
PDA	PDA Craving	4.20 (1.29)	2.97 (1.35)	**2.59****	PDA Stroop	17.99 (4.90)	13.62 (36.43)	.82	.17	.02
WK+1	QSU	2.39 (2.05)	1.73 (1.97)	**4.91***	Stroop effect	11.62 (69.39)	-.92 (89.46)	1.82	-.13	.04
WK+4	QSU	2.15 (2.00)	1.45 (1.97)	3.81	Stroop effect	19.54 (76.26)	16.60 (7.40)	.00	-.02	.18
Mean	QSU	3.94 (1.83)	3.17 (1.94)	**8.35****	Stroop effect	25.11 (45.19)	19.27 (64.29)	.52	.17	.20

Table Note: Hypotheses1B, 2B, and 3B. BIDR = Balanced Inventory of Desirable Responding; NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = quit day; PDA = assessments given on a personal digital assistant (PDA) for one week following quit day; WK+1 = one week following quit day; WK+4 = four weeks following quit day; Mean = Mean of 5 laboratory sessions; QSU = Questionnaire for Smoking Urges (0 to 10); PDA Craving (1 to 7); Ns vary from 196 (NON) to 160 (WK+4); N = 117 for PDA analyses; degrees of freedom for ANCOVA analyses = NON (1, 191), AB (1, 191), QD (1, 165), WK+1 (1, 162) and WK+4 (1, 145); *p<.05, **p<.01

Table 11

Differences in Explicit and Implicit Expectancies from Smoking for Low and High BIDR Participants (Strategy 1)

	Self-Report	Low BIDR M (SD)	High BIDR M (SD)	ANCOVA Low and High BIDR (F value)	Implicit	Low BIDR M (SD)	High BIDR M (SD)	ANCOVA Low and High BIDR (F value)	Partial Correlation between SR and Implicit (r) Low BIDR	Partial Correlation between SR and Implicit (r) High BIDR
NON	SCQ	5.83 (2.33)	4.76 (2.59)	**7.36****	EA effect	88.11 (554.49)	-69.56 (51.50)	3.22	.03	.10
AB	SCQ	7.10 (2.16)	6.66 (2.32)	1.69	EA effect	187.17 (559.64)	-3.58 (596.66)	**5.51***	**.23***	**.26***
QD	SCQ	5.38 (2.46)	4.17 (2.69)	**8.88****	EA effect	16.57 (412.39)	-164.72 (581.82)	**4.03***	.18	.19
WK+1	SCQ	4.24 (2.47)	3.14 (2.28)	**8.37****	EA effect	-8.83 (609.82)	-253.62 (669.59)	**6.52***	.06	**.34****
WK+4	SCQ	3.84 (2.41)	2.67 (2.07)	**8.76****	EA effect	-103.79 (51.40)	-253.34 (568.71)	2.41	**.36****	**.46****
Mean	SCQ	5.51 (1.87)	4.47 (2.07)	**12.37****	EA effect	6.29 (382.94)	-105.06 (471.94)	**6.71***	**.30****	**.43****

Table Note: Hypotheses1C, 2C, and 3C. BIDR = Balanced Inventory of Desirable Responding; NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = quit day; WK+1 = one week following quit day; WK+4 = four weeks following quit day; Mean = Mean of 5 laboratory sessions; EA = Expectancy Accessibilty; SCQ = Smoking Consequences items (0 - 10); Ns vary from 194 (NON) to 135 (WK+4); degrees of freedom for ANCOVA analyses = NON (1, 189), AB (1, 189), QD (1, 164), WK+1 (1, 148) and WK+4 (1, 130); *p<.05, **p<.01

Table 12

Correlations Between BIDR Scores and Explicit and Implicit Attitudes Toward Smoking (Strategy 2)

	Self-report	Partial Correlation between BIDR and Self-Report (r)	Implicit	Partial Correlation between BIDR and Implicit (r)	Moderation Effect Regression (b value)
NON	SDS	**-.16***	IAT effect	-.06	b = .029 (SE = .021) ΔR^2 = .009
AB	SDS	-.04	IAT effect	-.06	b = .003 (SE = .021) ΔR^2 = .000
QD	SDS	-.03	IAT effect	-.13	b = .020 (SE = .018) ΔR^2 = .017
PDA	PDA Attitudes	**-.23***	PDA IAT effect	.02	b = .013 (SE = .057) ΔR^2 = .001
WK+1	SDS	-.08	IAT effect	-.11	b = .022 (SE = .019) ΔR^2 = .008
WK+4	SDS	**-.16***	IAT effect	.03	b = -.001 (SE = .020) ΔR^2 = .000
Mean	SDS	-.12	IAT effect	-.07	b = .012 (SE = .018) ΔR^2 = .002

Table Note: Hypotheses1A, 2A, and 3A. NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = quit day; PDA = assessments given on a personal digital assistant (PDA) for one week following quit day; WK+1 = one week following quit day; WK+4 = four weeks following quit day; Mean = Mean of 5 laboratory sessions; BIDR = Balanced Inventory of Desirable Responding; IAT = Implicit Association Test; Explicit Attitudes = Semantic Differentiation Scales (-3 to +3); Ns range from 195 (NON) to 148 (WK+4); N = 103 for PDA analyses; *p<.05, **p<.01. r values are Pearson partial correlation coefficients; b values for moderation effect are unstandardized regression coefficients for the interaction between BIDR scores and implicit measures in regression analysis (see text)

Table 13

Correlations Between BIDR Scores and Craving and Attentional Bias Toward Smoking Cues (Strategy 2)

	Self-report	Partial Correlation between BIDR and Self-Report (r)	Implicit	Partial Correlation between BIDR and Implicit (r)	Moderation Effect Regression (b value)
NON	QSU	**-.18***	Stroop effect	.12	b = .000 (SE = .000) ΔR^2 = .000
AB	QSU	-.12	Stroop effect	-.09	b = -.000 (SE = .000) ΔR^2 = .001
QD	QSU	**-.27****	Stroop effect	.04	**b = -.001 (SE = .000)**** **ΔR^2 = .066**
PDA	PDA Craving	**-.42****	PDA Stroop effect	-.13	b = -.000 (SE = .001) ΔR^2 = .001
WK+1	QSU	**-.21****	Stroop effect	-.11	b = .000 (SE = .000) ΔR^2 = .000
WK+4	QSU	-.16	Stroop effect	.02	b = .000 (SE = .000) ΔR^2 = .011
Mean	QSU	**-.24****	Stroop effect	.00	b = .000 (SE = .000) ΔR^2 = .003

Table Note: Hypotheses1B, 2B, and 3B. NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = quit day; PDA = assessments given on a personal digital assistant (PDA) for one week following quit day; WK+1 = one week following quit day; WK+4 = four weeks following quit day; Mean = Mean of 5 laboratory sessions; BIDR = Balanced Inventory of Desirable Responding; QSU = Questionnaire for Smoking Urges (0 to 10); Ns range from 196 (NON) to 151 (WK+4); N = 112 for PDA analyses; *p<.05, **p<.01. r values are Pearson Partial correlation coefficients; b values for moderation effect are unstandardized regression coefficients for the interaction between BIDR scores and implicit measures in regression analysis (see text)

Table 14

Correlations Between BIDR Scores and Explicit and Implicit Expectancies from Smoking (Strategy 2)

	Self-report	Partial Correlation between BIDR and Self-Report (r)	Implicit	Partial Correlation between BIDR and Implicit (r)	Moderation Effect Regression (b value)
NON	SCQ	**-.21****	EA effect	-.10	b = -.000 (SE = .000) ΔR^2 = .000
AB	SCQ	**-.15***	EA effect	**-.15***	b = -.000 (SE = .000) ΔR^2 = .000
QD	SCQ	**-.29****	EA effect	**-.19***	b = -.000 (SE = .000) ΔR^2 = .000
WK+1	SCQ	**-.23****	EA effect	**-.19***	b = .000 (SE = .000) ΔR^2 = .008
WK+4	SCQ	**-.25****	EA effect	**-.21***	b = -.000 (SE = .000) ΔR^2 = .001
Mean	SCQ	**-.30****	EA effect	**-.19****	b = -.000 (SE = .000) ΔR^2 = .000

Table Note: Hypotheses1C, 2C, and 3C. NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = quit day; WK+1 = one week following quit day; WK+4 = four weeks following quit day; Mean = Mean of 5 laboratory sessions; BIDR = Balanced Inventory of Desirable Responding; EA = Expectancy Accessibilty; SCQ = Smoking Consequences items (0 - 10); Ns range from 192 (NON) to 131 (WK+4); *p<.05, **p<.01. r values are Pearson Partial correlation coefficients; b values for moderation effect are unstandardized regression coefficients for the interaction between BIDR scores and implicit measures in regression analysis (see text)

Table 15

Effect of Socially Desirable Responding (SDR) Across States, NON vs. AB sessions (Strategy 1 and 2)

	NON session		AB session					
	Low BIDR M (SD)	High BIDR M (SD)	Low BIDR M (SD)	High BIDR M (SD)	Main Effect of State (F value)	Main Effect of dich SDR (F Value)	Interaction: State x dich. SDR (F Value)	Interaction: State x cont. SDR (F Value)
SDS	-1.73 (1.04)	-1.97 (1.12)	-1.83 (1.09)	-1.84 (1.17)	.08	.87	1.97	2.48
QSU	4.01 (2.63)	2.99 (2.48)	6.12 (2.25)	5.77 (2.51)	**153.93****	**4.76***	2.78	.90
SCQ	5.86 (2.36)	4.87 (2.49)	7.11 (2.18)	6.68 (2.35)	**64.78****	**4.90***	2.01	.67
IAT	-.93 (.52)	-.94 (.50)	-.81 (.54)	-.86 (.57)	**9.99****	1.12	.46	.01
Stroop	23.22 (73.21)	36.41 (88.72)	37.60 (92.31)	25.06 (83.08)	.01	.00	2.66	3.68
EA	104.87 (558.07)	-68.89 (51.90)	168.47 (561.57)	-25.33 (578.22)	1.13	**7.10****	.27	.46

Table Note: Hypotheses 4A, 4B, and 4C. The F value for the State x dich. (dichotomous) SDR = interaction effect for Strategy 2. The F value for the State x cont. (continuous) SDR = interaction effect for Strategy 1. BIDR = Balanced Inventory of Desirable Responding; SDR = Socially Desirable Responding; NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); SDS = Semantic Differential Scales (-3 to +3); QSU = Questionnaire of Smoking Urges (0 -10); SCQ = Smoking Consequences items (0 - 10); IAT = Implicit Association Test; Stroop = Smoking Stroop Task; EA = Expectancy Accessibilty; N = 178 (df = 1, 173) for NON and AB sessions (participants who completed both sessions); *p<.05, **p<.01

Table 16

Effect of Socially Desirable Responding (SDR) Across States, AB vs. QD Sessions (Strategy 1 and 2)

	AB session		QD session					
	Low BIDR M (SD)	High BIDR M (SD)	Low BIDR M (SD)	High BIDR M (SD)	Main Effect of State (F value)	Main Effect of dich. SDR (F Value)	Interaction: State x dich. SDR (F Value)	Interaction: State x cont. SDR (F Value)
SDS	-1.86 (1.07)	-1.81 (1.17)	-2.40 (.84)	-2.31 (1.11)	**36.92****	.11	.04	.01
QSU	6.04 (2.26)	5.81 (2.51)	3.70 (2.28)	2.69 (2.41)	**20.59****	**4.29***	**3.99***	**5.61***
SCQ	7.01 (2.17)	6.68 (2.35)	5.40 (2.47)	4.19 (2.73)	**101.71****	**5.28***	**4.81***	**6.74***
IAT	-.82 (.53)	-.84 (.55)	-.74 (.56)	-.79 (.55)	2.91	1.53	.30	1.12
Stroop	41.41 (89.38)	26.43 (82.69)	15.58 (79.95)	16.34 (6.26)	**4.82***	.99	1.05	1.68
EA	155.27 (562.10)	-4.05 (587.54)	9.19 (416.52)	-178.67 (572.80)	**9.85****	**6.64***	.20	.00

Table Note: Hypotheses4A, 4B, and 4C. The F value for the State x dich. (dichotomous) SDR = interaction effect for Strategy 2. The F value for the State x cont. (continuous) SDR = interaction effect for Strategy 1. BIDR = Balanced Inventory of Desirable Responding; SDR = Socially Desirable Responding; AB = 12 hour abstinent session (pre-quit); QD = quit day; SDS = Semantic Differential Scales (-3 to +3); QSU = Questionnaire of Smoking Urges (0 -10); SCQ = Smoking Consequences items (0 - 10); IAT = Implicit Association Test; Stroop = Smoking Stroop Task; EA = Expectancy Accessibilty; N = 169 (df = 164) for NON and AB sessions (participants who completed both sessions); *p<.05, **p<.01

Table 17

Effect of Socially Desirable Responding (SDR) Across Settings, Lab vs. Field (Strategy 1 and 2)

	Lab			Field					
	Low BIDR M (SD)	High BIDR M (SD)		Low BIDR M (SD)	High BIDR M (SD)	Main Effect of Setting (F value)	Main Effect of dich. SDR (F Value)	Interaction: Setting x dich. SDR (F Value)	Interaction: Setting x cont. SDR (F Value)
SDS	-2.48 (.72)	-2.26 (1.14)	PDA Attitudes	-.96 (1.42)	-1.52 (1.39)	**111.00****	.66	**12.08****	**7.59****
QSU	3.07 (1.94)	2.01 (1.81)	PDA Craving	4.20 (1.29)	2.97 (1.35)	**5.44***	**14.93****	.14	.11
IAT	-.67 (.42)	-.65 (.46)	PDA IAT	-.30 (.38)	-.27 (.37)	**14.20****	.04	.17	.01
Stroop	7.05 (5.8)	6.81 (64.7)	PDA Stroop	17.99 (4.90)	13.62 (36.43)	.01	.64	.06	.38

Table Note: Hypotheses 5A, 5B, 5C, and 5D. The F value for the Setting x dich. (dichotomous) SDR = interaction effect for Strategy 2. The F value for the Setting x cont. (continuous) SDR = interaction effect for Strategy 1. BIDR = Balanced Inventory of Desirable Responding; SDR = Socially Desirable Responding; Lab = mean of assessments given in laboratory on quit day and one week after quit day (WK+1); Field = mean of assessments given on PDA during the week between quit day and one week after quit day (WK+1); SDS = Semantic Differential Scales (-3 to +3); QSU = Questionnaire of Smoking Urges (0 -10); IAT = Implicit Association Test; Stroop = Smoking Stroop Task; N = 107 (df = 1, 102) for AB and QD sessions (participants who completed both sessions); *p<.05, **p<.01

Table 18

Summary of Study Hypotheses

Aim	Hypothesis	Outcome	Notes
1	1A: Negative association between BIDR and SR attitudes	Partial Support	Mixed support in lab; supported in field
	1B: Negative association between BIDR and SR craving	Supported	
	1C: Negative association between BIDR and SR outcome expectancies	Supported	
2	2A: No association between BIDR and implicit attitudes	Supported	
	2B: No association between BIDR and attentional bias	Supported	
	2C: No association between BIDR and implicit expectancies	Not Supported	Positive association between BIDR and EA
3	3A: Association between SR and implicit attitudes weaker in high BIDR	Not Supported	No moderation
	3B: Association between attentional bias and craving weaker in high BIDR	Partial Support	Moderation only on QD
	3C: Association between SR and implicit expectancies weaker in high BIDR	Not Supported	No moderation
4	4A: Association between BIDR and SR (but not implicit) attitudes vary across states	Partial Support	
	4B: Association between BIDR and SR craving (but not attentional bias) varies across states	Partial Support	Association differed between AB and QD
	4C: Association between BIDR and SR (but not implicit) expectancies vary across states	Partial Support	Association differed between AB and QD
5	5A: Association between BIDR and SR craving stronger in lab vs. field	Not Supported	No difference in correlation
	5B: Association between BIDR and SR attitudes stronger in lab vs. field	Not Supported	Correlation higher in field
	5C: No difference in association between BIDR and attentional bias in lab vs. field	Supported	
	5D: No difference in association between BIDR and implicit attitudes in lab vs. field	Supported	

Table Note: SR = self-report; BIDR = Balanced Inventory of Desirable Responding; EA = Expectancy Accessibility (implicit expectancies)

NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = quit day

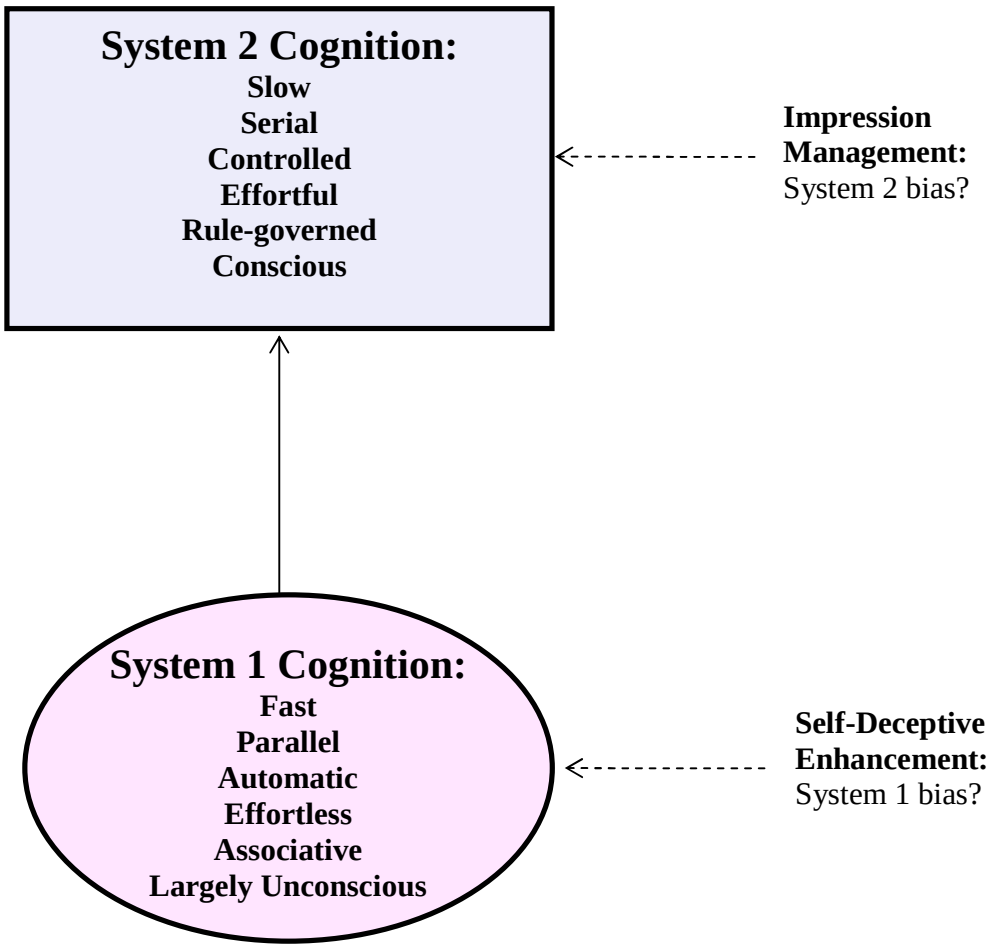


Figure 1. Dual process model of socially desirable responding (SDR) which hypothesizes that Self-Deceptive Enhancement (self-deception) acts on system 1 cognition and Impression Management (other-deception) acts on system 2 cognition.

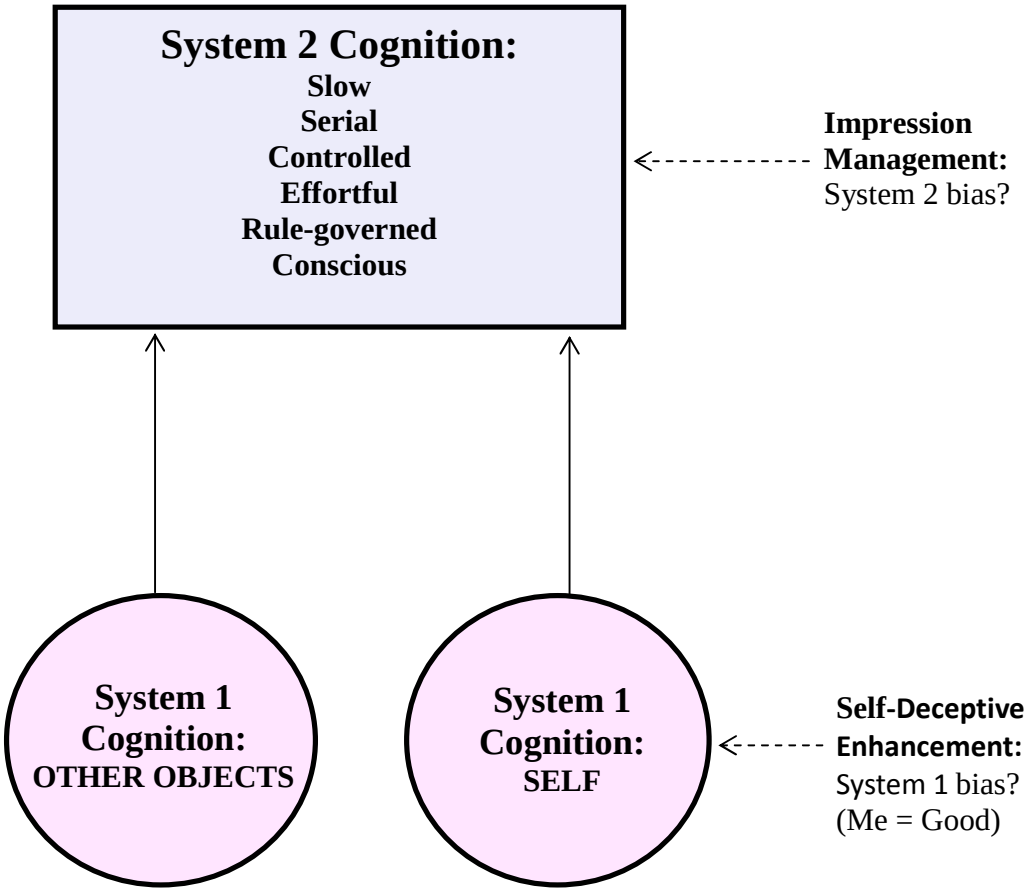


Figure 2. Dual process model of socially desirable responding (SDR) which hypothesizes that Self-Deceptive Enhancement (self-deception) acts on system 1 cognition specifically related to evaluative ego-related content (i.e., Me = Good), and Impression Management (other-deception) acts on system 2 cognition.

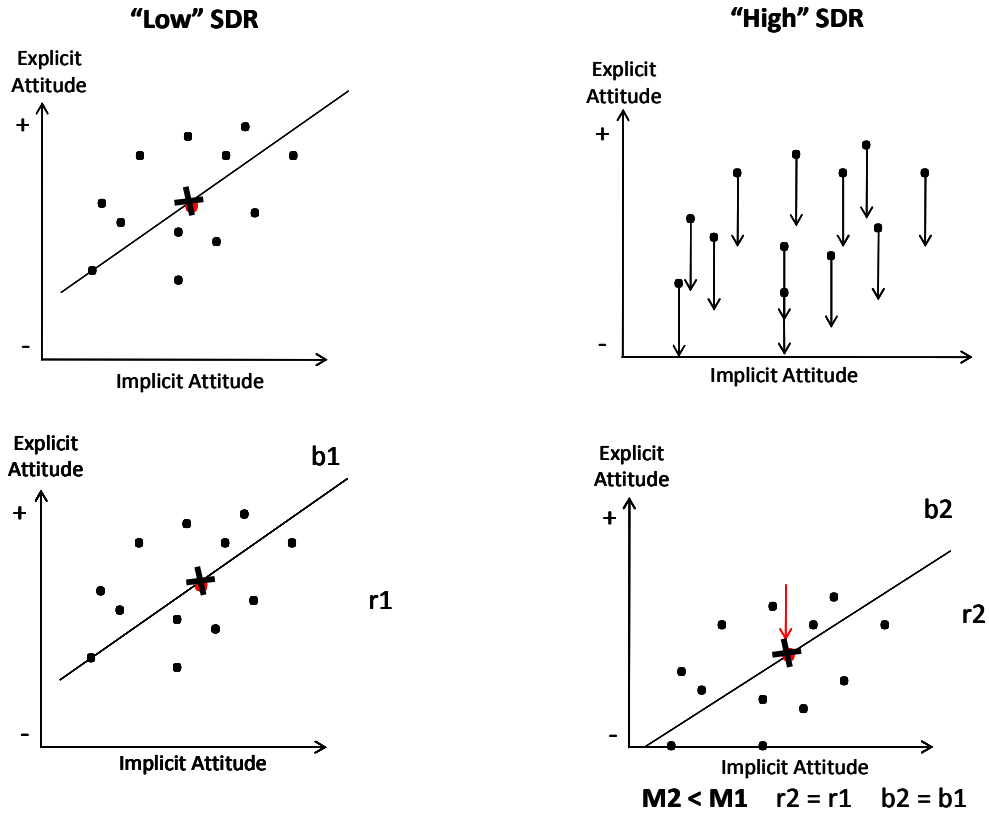


Figure 3. Possible effect of Socially Desirable Responding (SDR) on self-report measures and the association between self-report and implicit measures. The Figure assumes that the effect of SDR is similar across all participants high in SDR (see text for details). b1 = original slope; b2 = slope adjusted for the effect of SDR; r1 = original correlation between implicit and explicit attitudes; r2 = correlation adjusted for the effect of SDR; M1 = original mean value ("x") of implicit and explicit attitudes; M2 = mean value adjusted for the effect of SDR.

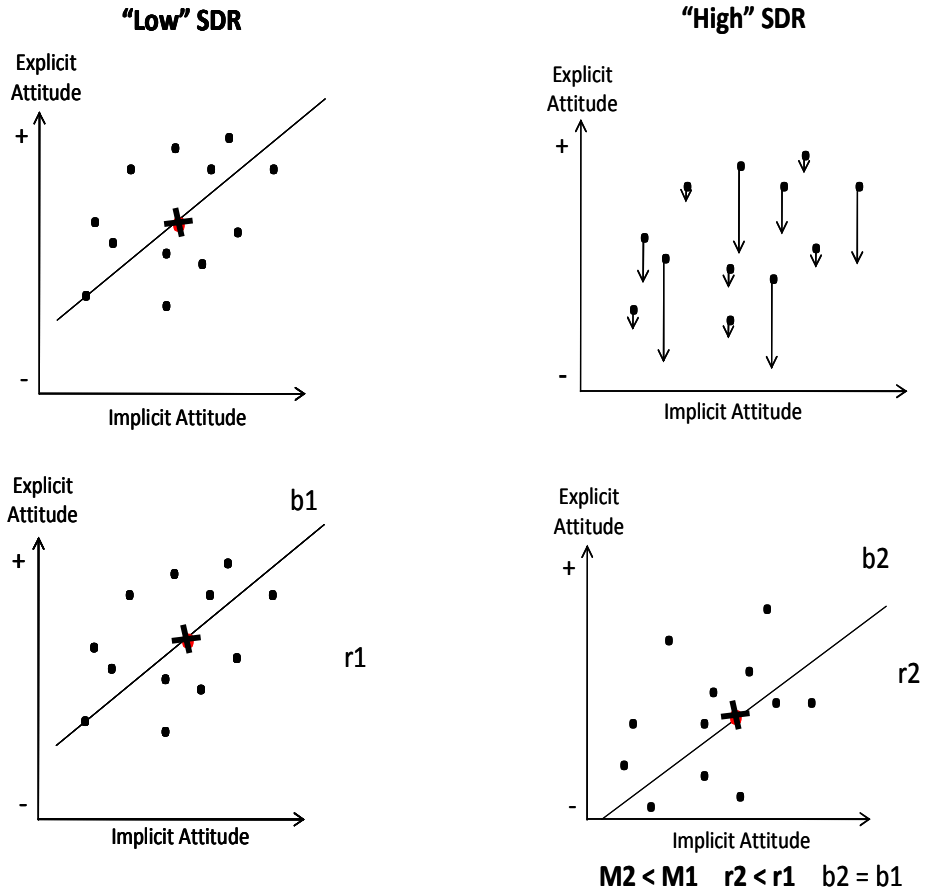


Figure 4. Possible effect of SDR on self-report measures and the association between self-report and implicit measures. The Figure assumes that the effect of Socially Desirable Responding (SDR) varies across all participants high in SDR (see text for details). b1 = original slope; b2 = slope adjusted for the effect of SDR; r1 = original correlation between implicit and explicit attitudes; r2 = correlation adjusted for the effect of SDR; M1 = original mean value ("x") of implicit and explicit attitudes; M2 = mean value adjusted for the effect of SDR.

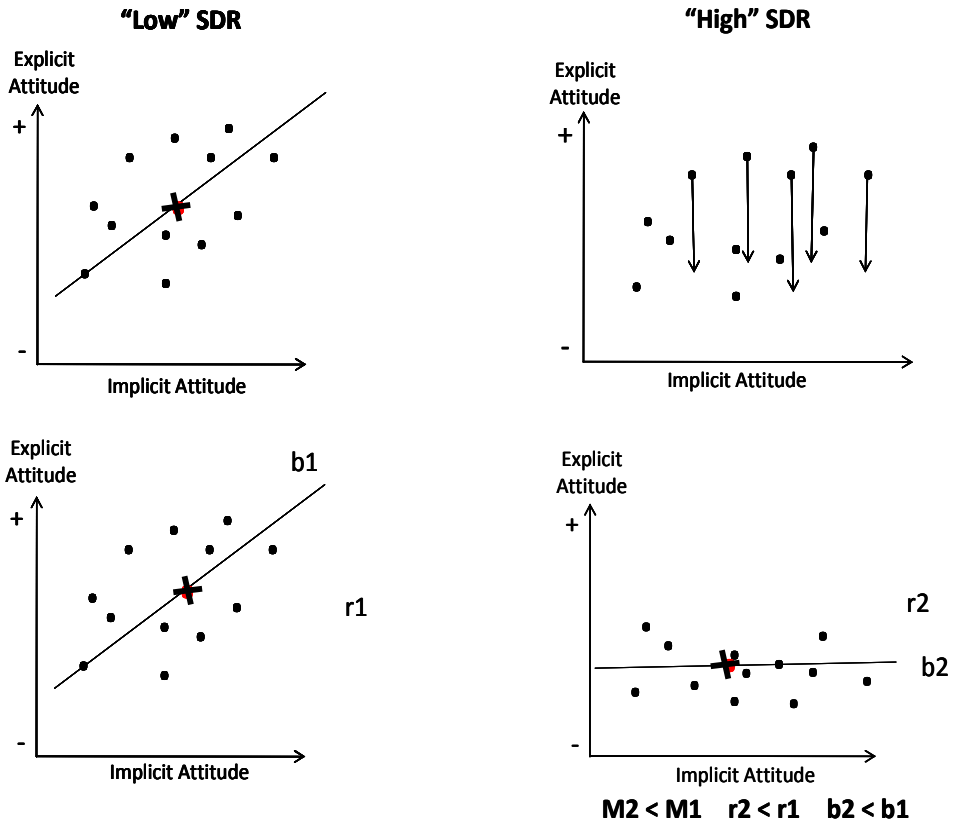


Figure 5. Possible effect of Socially Desirable Responding (SDR) on self-report measures and the association between self-report and implicit measures. The Figure assumes that the effect of SDR is largest in individuals with the most positive "true" attitudes (see text for details). b1 = original slope; b2 = slope adjusted for the effect of SDR; r1 = original correlation between implicit and explicit attitudes; r2 = correlation adjusted for the effect of SDR; M1 = original mean value ("x") of implicit and explicit attitudes; M2 = mean value adjusted for the effect of SDR.

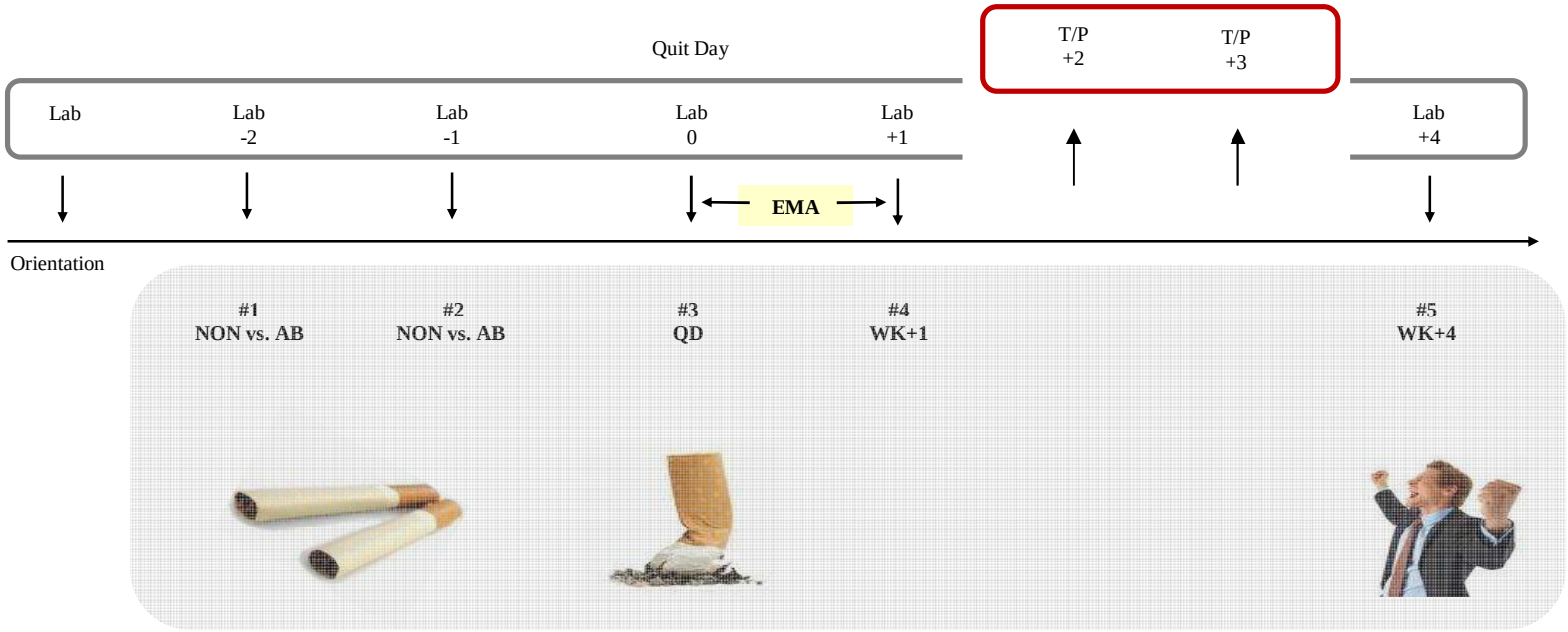


Figure 6. Summary of study design. Lab = sessions conducted in the laboratory; T/P = sessions conducted via telephone; EMA = ecological momentary assessment data provided via measures on a personal digital assistant (PDA) for one week following participants' quit day; NON = non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = participants' quit day; WK+1 = one week following quit day; WK+4 = four weeks following quit day; Note: Order of completion of NON and AB sessions was counterbalanced across participants.

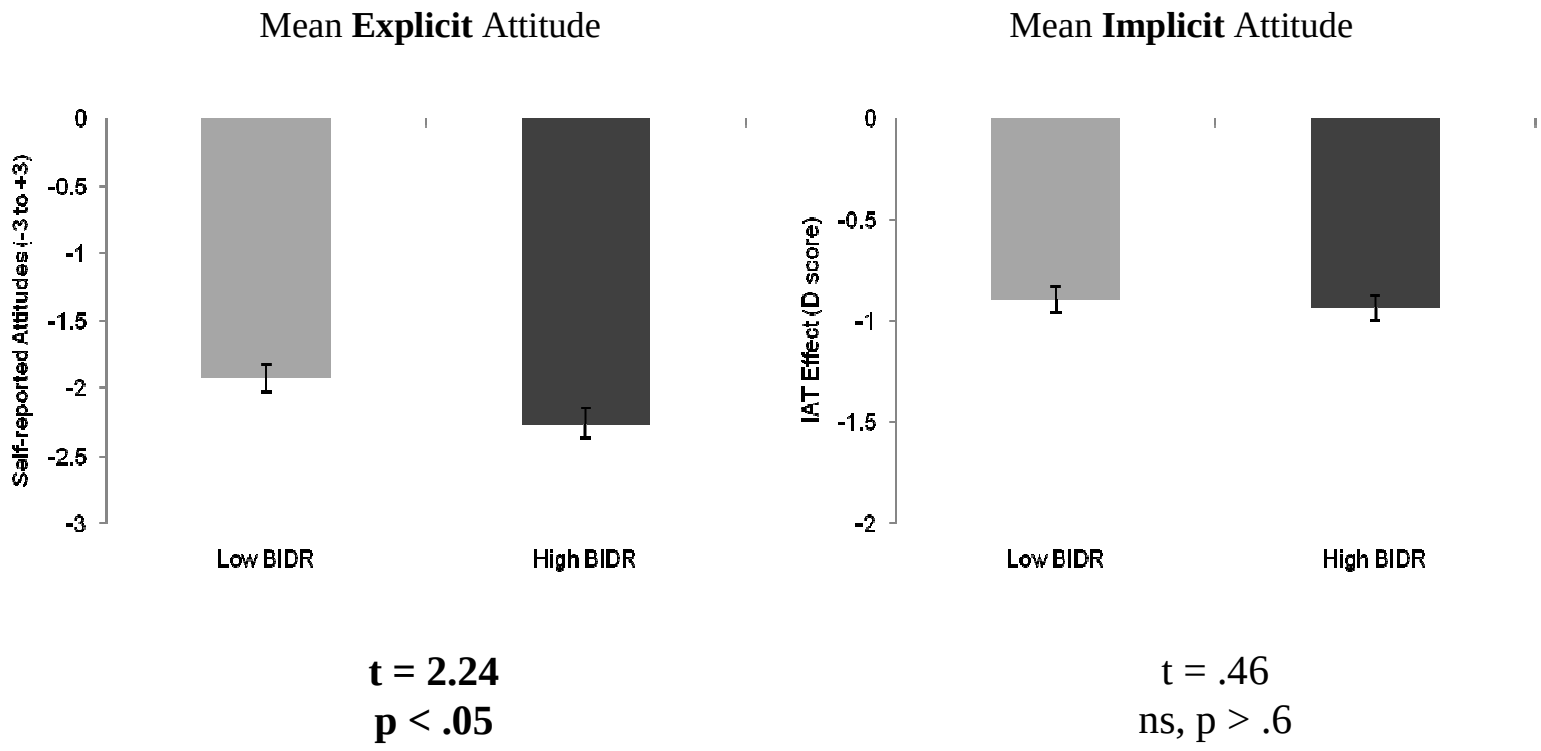
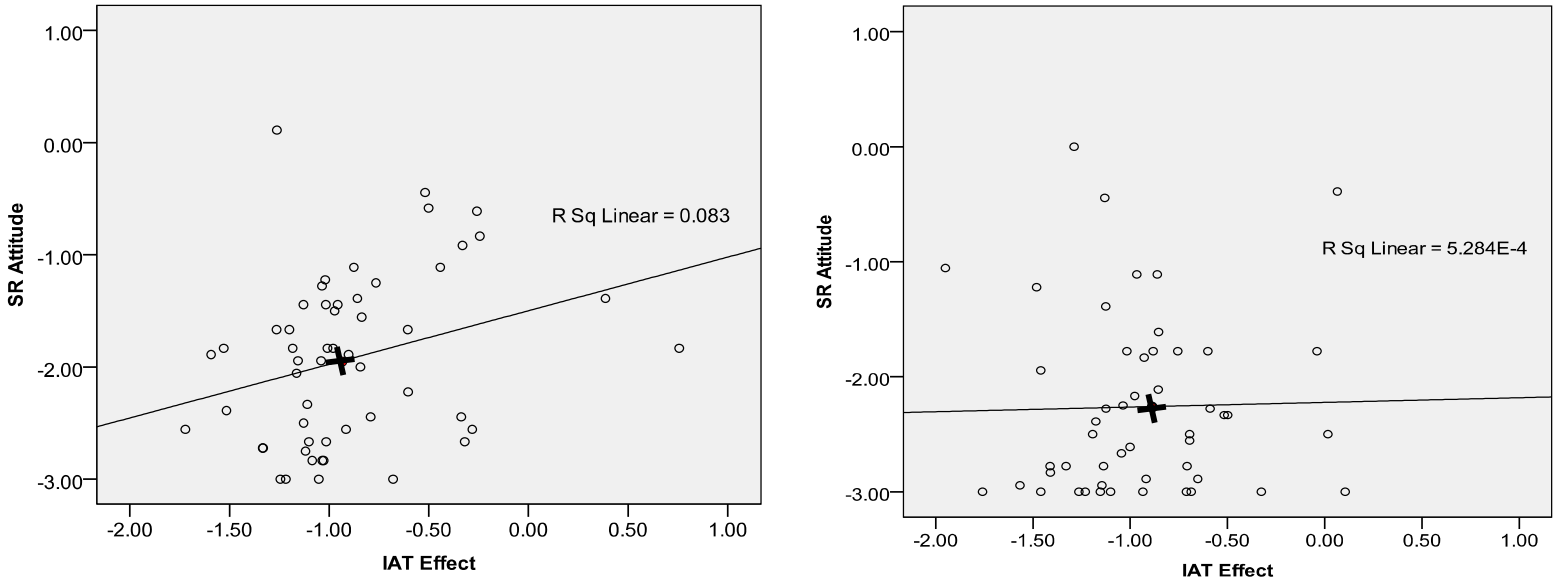


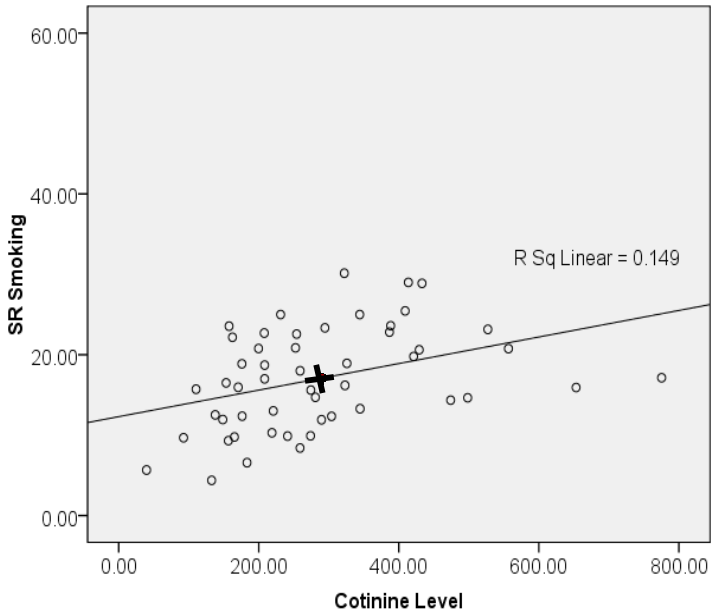
Figure 7. Differences in explicit and implicit attitudes for low and high Balanced Inventory of Desirable Responding (BIDR) participants (strategy 1); mean explicit attitudes were significantly more negative in the High BIDR group, however mean implicit attitudes did not differ significantly between these two groups.



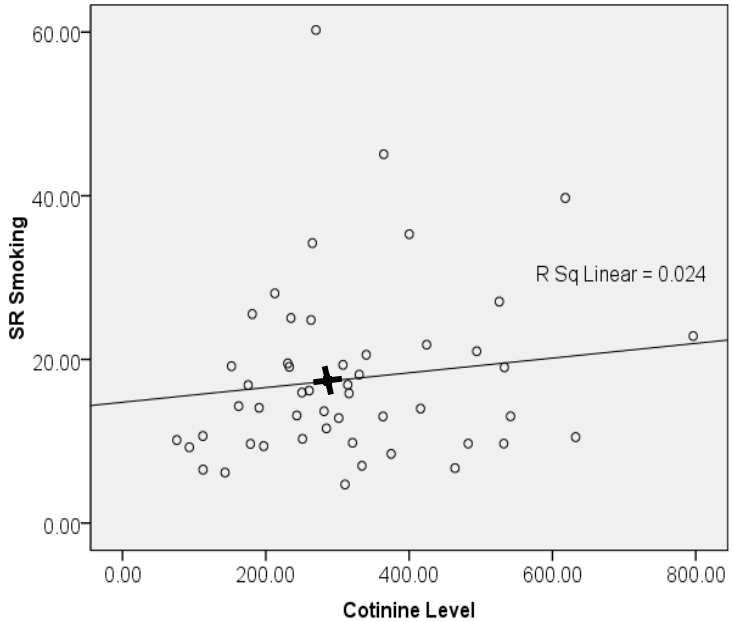
Low BIDR

High BIDR

Figure 8. Relationship between mean explicit and implicit attitudes toward smoking for low and high BIDR (strategy 1); the relationship between explicit and implicit attitudes toward smoking was weaker in the high group and the mean explicit attitude toward smoking was significantly more negative in this group.



Low BIDR



High BIDR

Figure 9. Relationship between mean self-reported smoking and biological measure of smoking for low and high BIDR; the relationship between self-report and biological measures of smoking did not differ between the two BIDR groups and the mean self-reported smoking was not significantly different between the two groups.

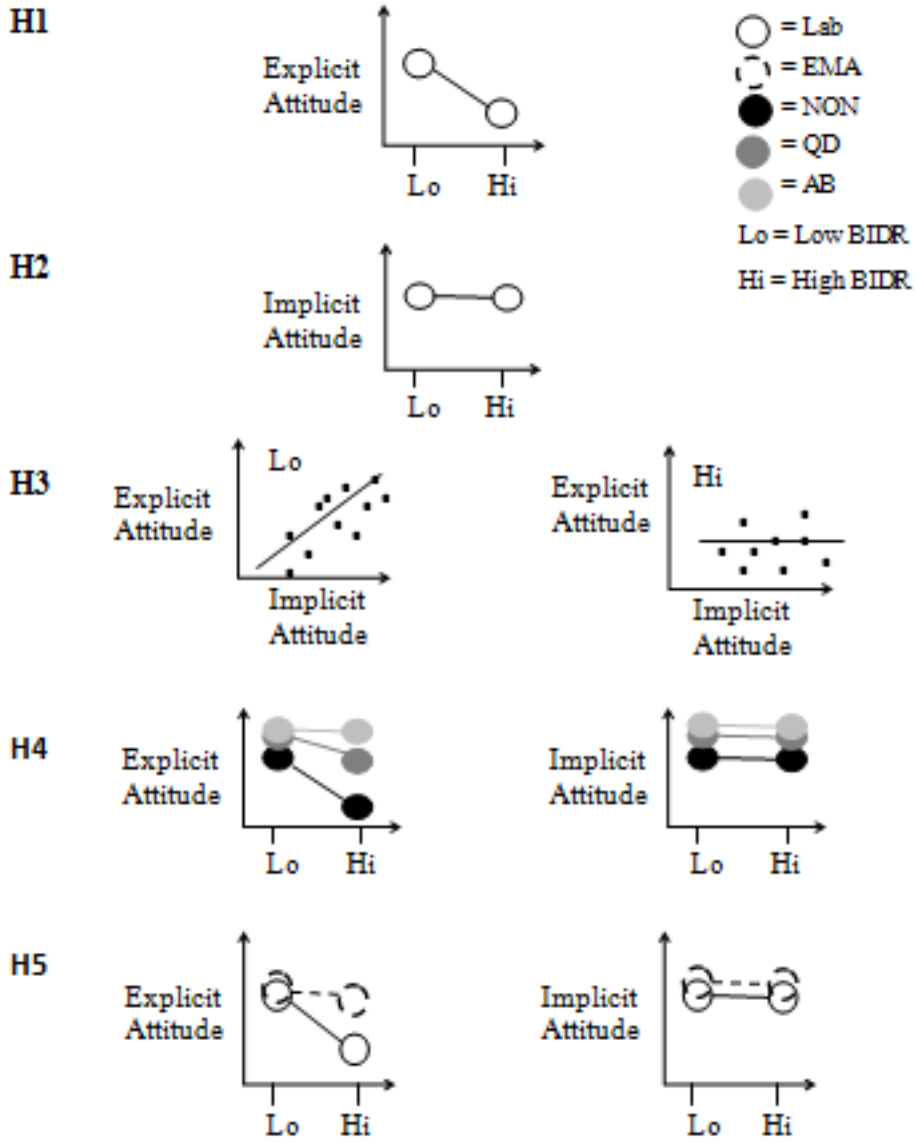
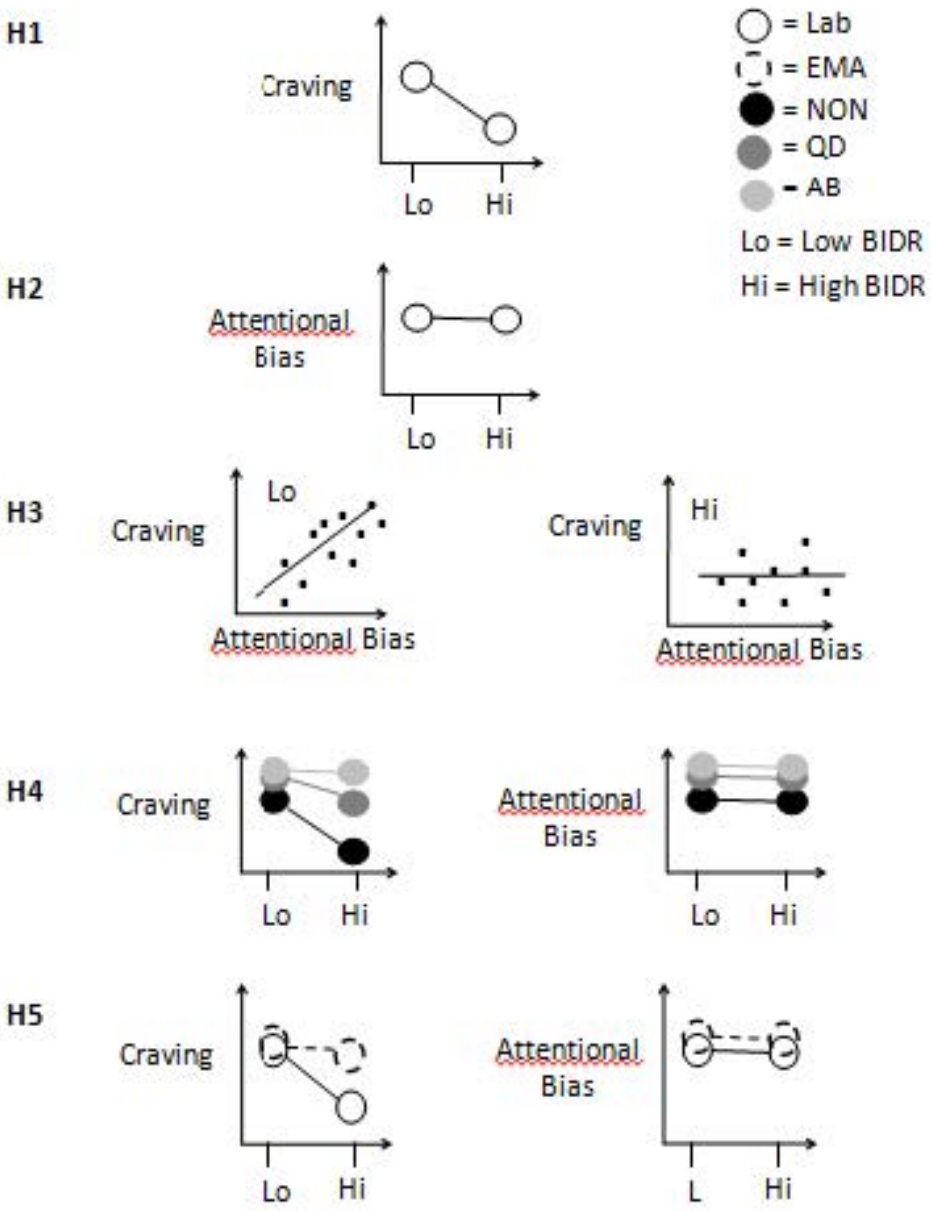
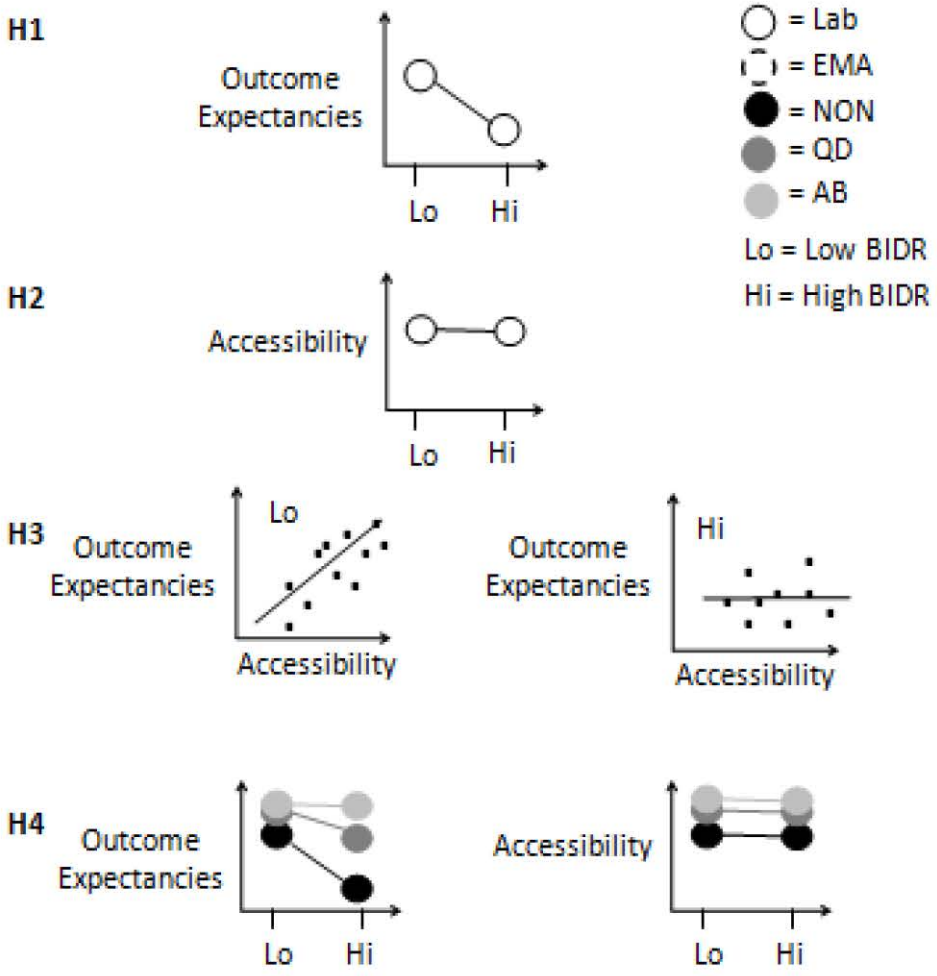
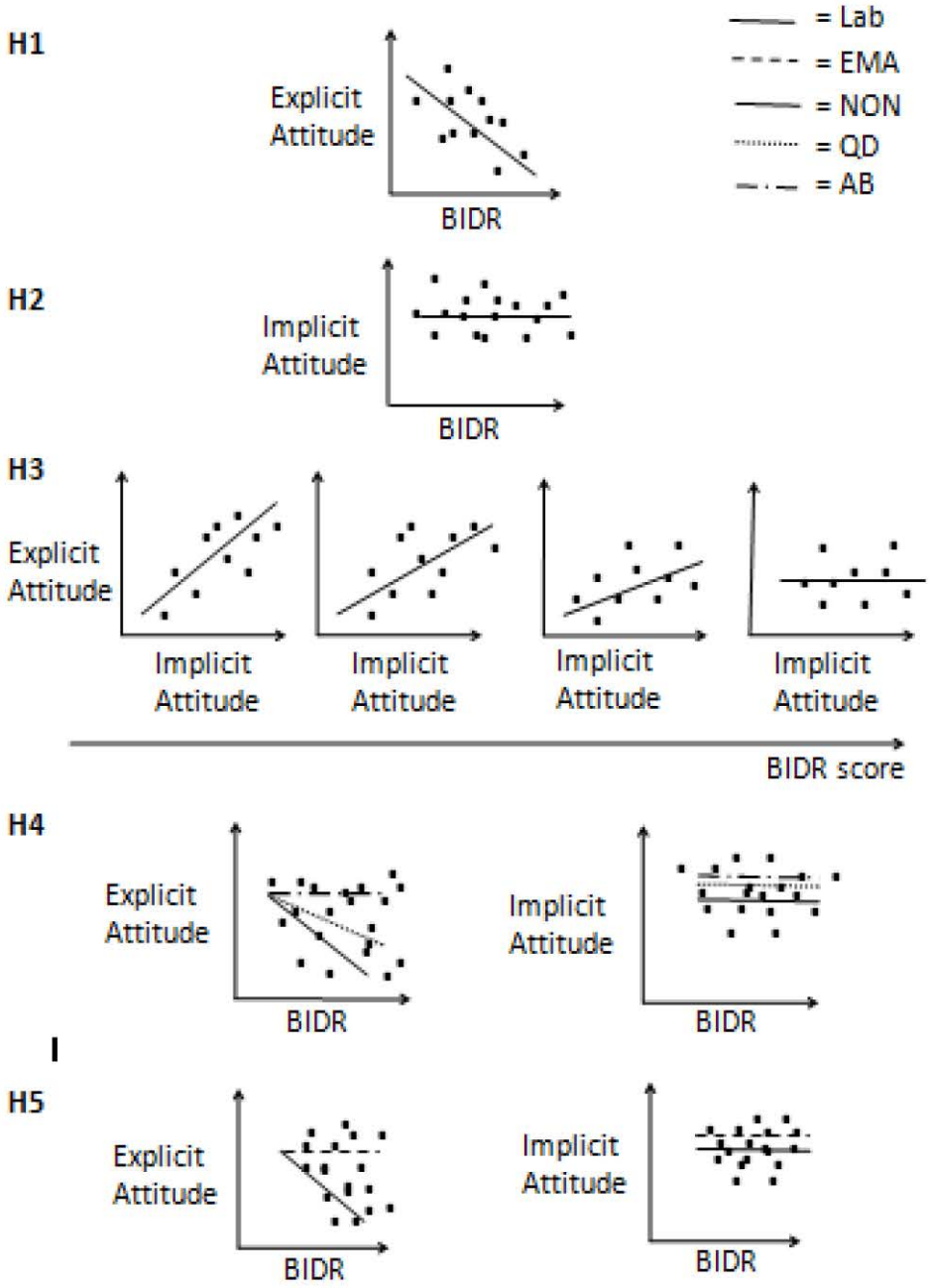


Figure 10. Study hypotheses; Lab = assessments conducted in laboratory; EMA = assessments conducted on the PDA; NON = non-abstinent session (pre-quit); QD = quit day; AB = abstinent session (pre-quit).


H1
Craving
Lo
Hi
= Lab
= EMA
= NON
= QD
= AB
Lo = Low BIDR
Hi = High BIDR
H2
Attentional Bias
Lo
Hi
H3
Craving
Lo
Attentional Bias
Craving
Hi
Attentional Bias
H4
Craving
Lo
Hi
Attentional Bias
Lo
Hi
H5
Craving
Lo
Hi
Attentional Bias
L
Hi


H1
Outcome Expectancies
Lo
Hi
= Lab
= EMA
= NON
= QD
= AB
Lo = Low BIDR
Hi = High BIDR
H2
Accessibility
Lo
Hi
H3
Outcome Expectancies
Lo
Accessibility
Outcome Expectancies
Hi
Accessibility
H4
Outcome Expectancies
Lo
Hi
Accessibility
Lo
Hi


H1
Explicit Attitude
BIDR
= Lab
= EMA
= NON
= QD
= AB
H2
Implicit Attitude
BIDR
H3
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Implicit Attitude
Implicit Attitude
Implicit Attitude
BIDR score
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Explicit Attitude
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H5
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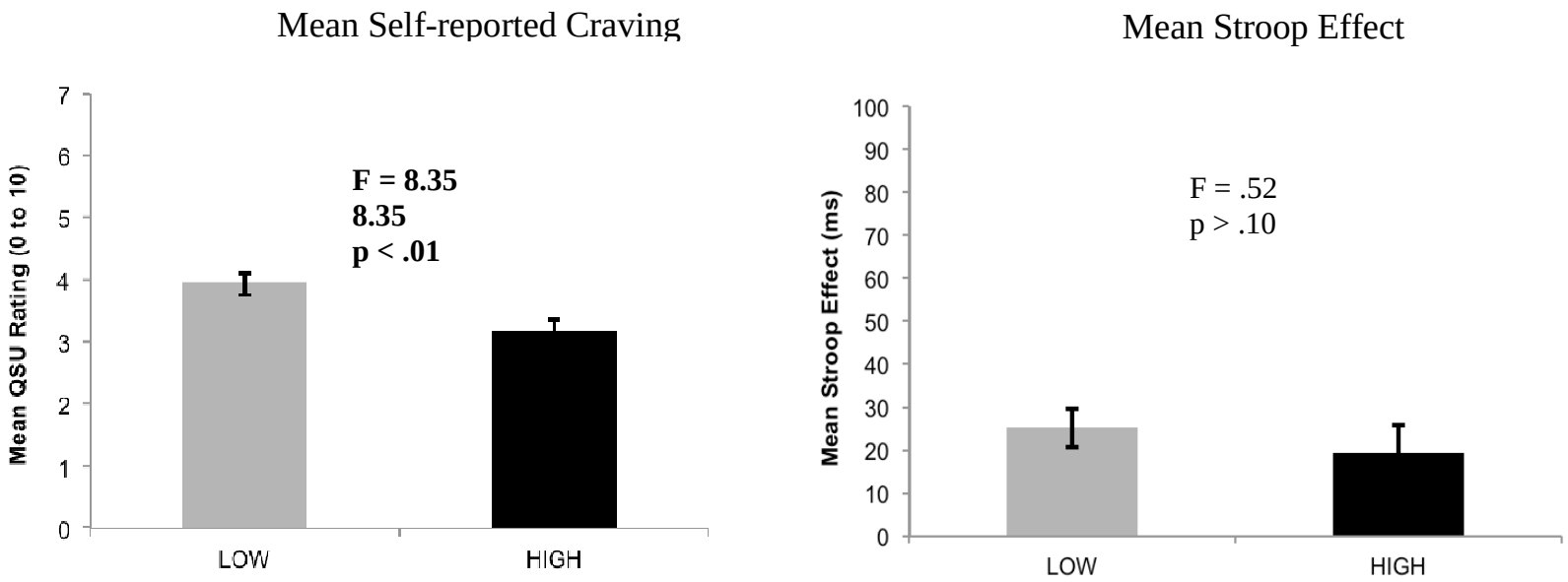
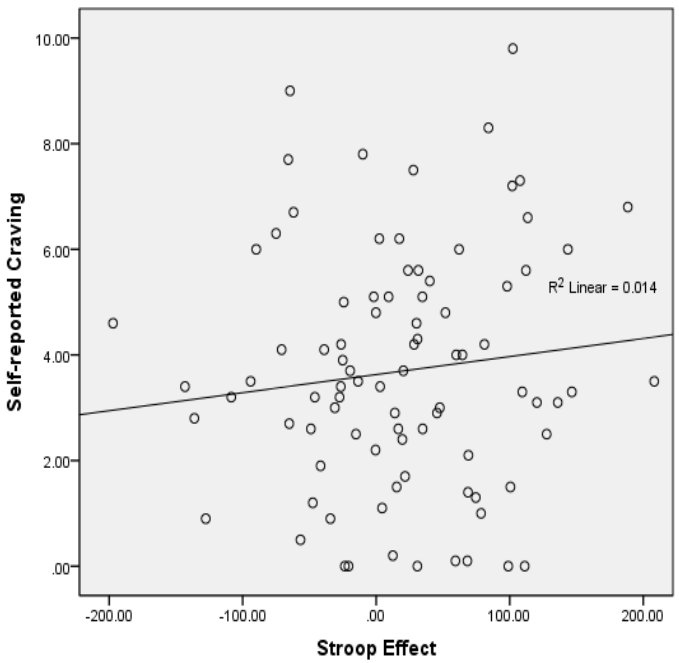
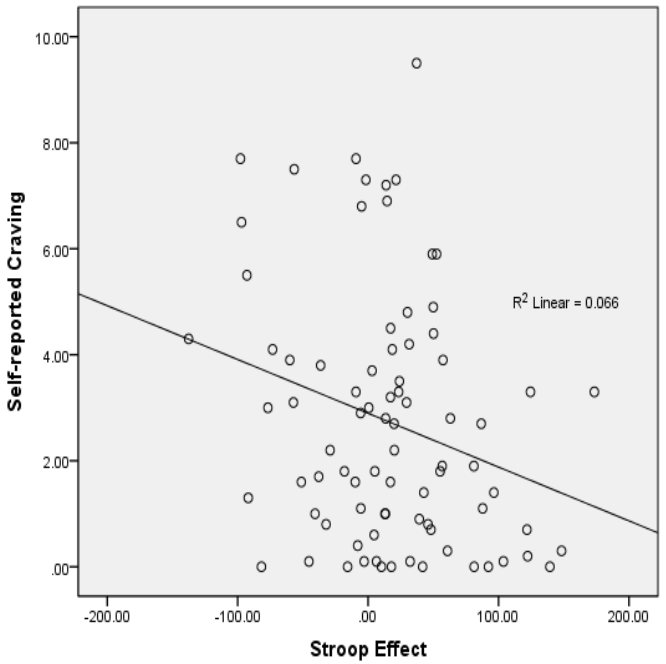


Figure 11. Differences in QSU ratings (explicit craving) and the Stroop effect (Attentional Bias; a measure of implicit craving) for low and high BIDR participants (Strategy 1); mean explicit craving differed significantly between low and high BIDR groups, however implicit craving did not differ significantly between the low and high groups.



Low BIDR



High BIDR

Figure 12. Relationship between QSU rating (explicit craving) and the Stroop Effect (Attentional Bias; a measure of implicit craving) for low and high BIDR on the quit day (Strategy 1); the relationship between QSU rating and the Stroop Effect was significantly more negative in the high group.

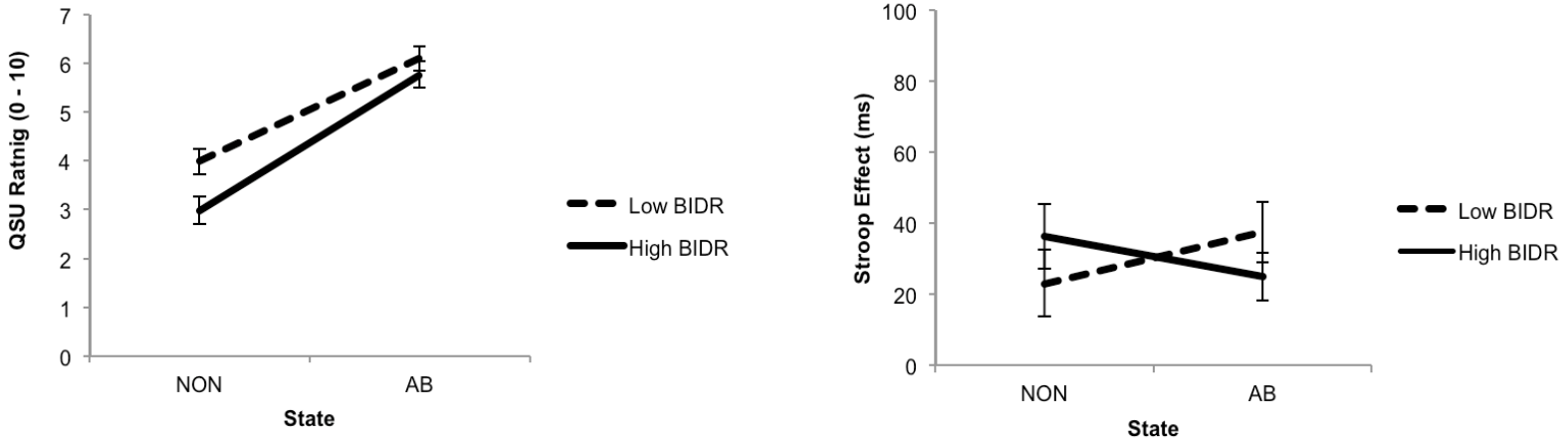


Figure 13. Differences in QSU ratings (explicit craving) and the Stroop effect (a measure of implicit craving) for low and high BIDR participants for the NON (Non-Abstinent) vs. AB (Abstinent) comparisons (Strategy 1); neither explicit nor implicit craving differed significantly between the low and high groups at the non-abstinent and abstinent sessions.

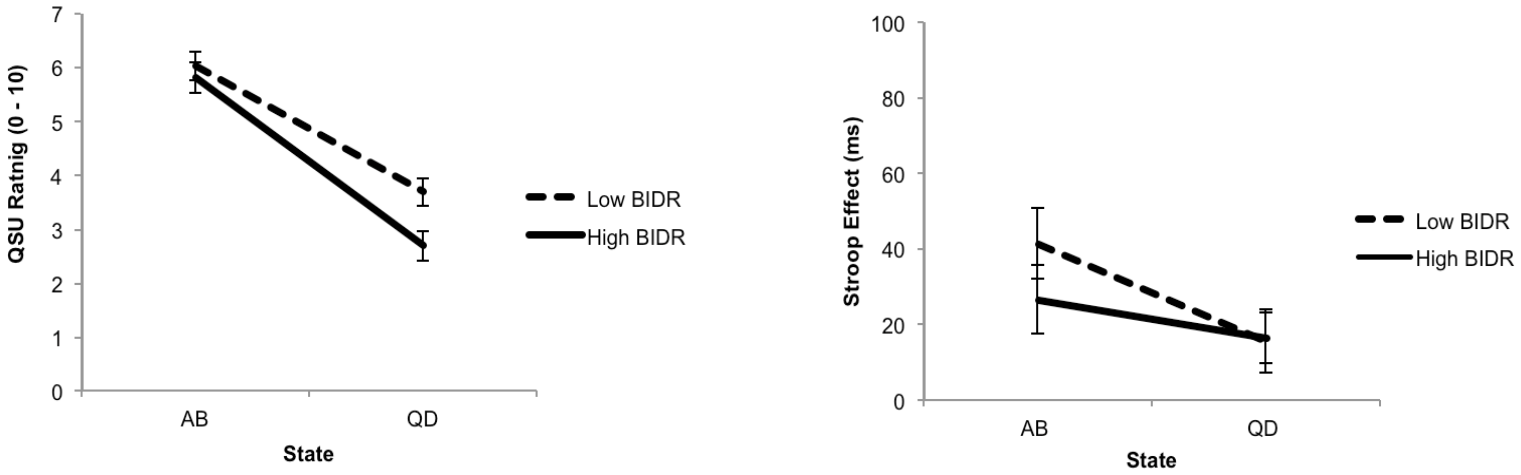


Figure 14. Differences in QSU ratings (explicit craving) and the Stroop effect (a measure of implicit craving) for low and high BIDR participants for the AB (Abstinent) vs. QD (Quit day) comparisons (Strategy 1); high BIDR participants reported significantly lower levels of craving at the quit day session but not the abstinent session, however implicit craving did not differ significantly between the low and high groups at the abstinent or quit day sessions.

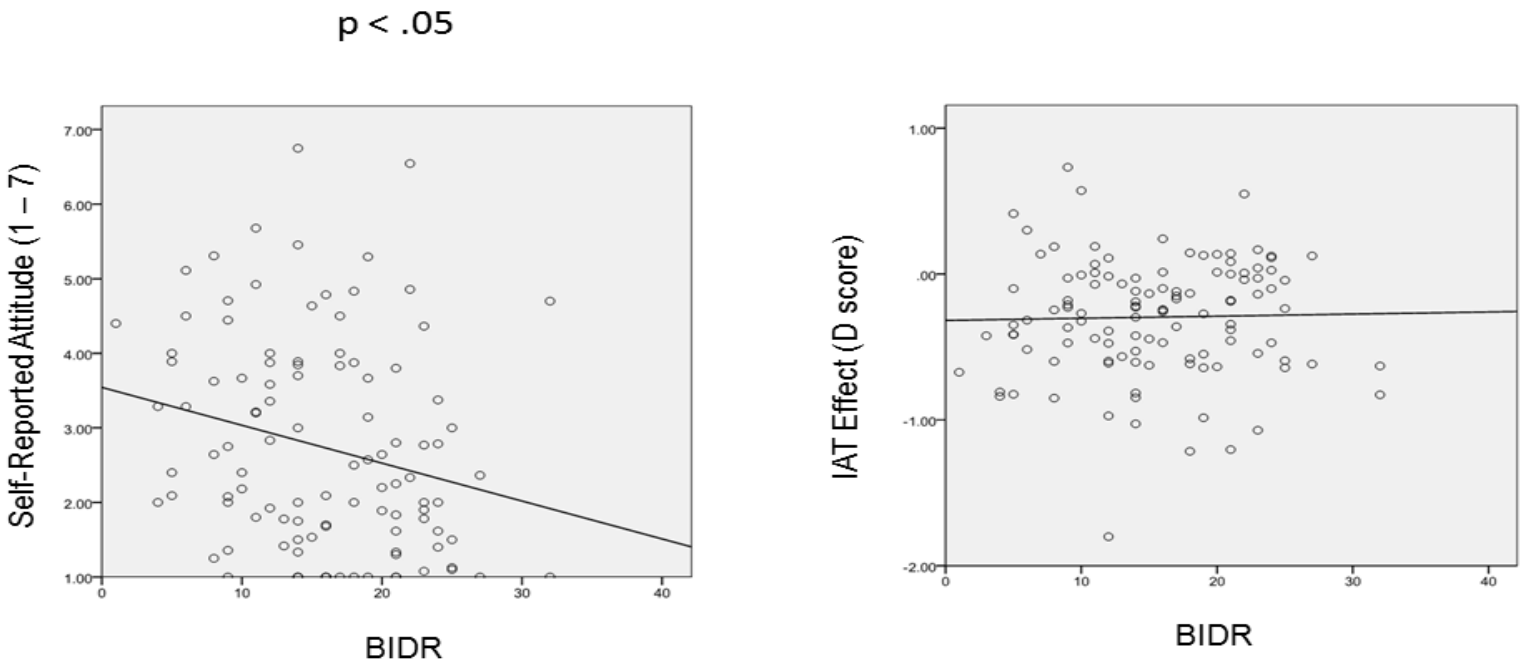


Figure 15. Relationship between attitude measures (explicit and implicit) and Balanced Inventory of Desirable Responding (BIDR) scores assessed outside of the laboratory on a personal digital assistant (PDA) (Strategy 1); mean explicit attitudes assessed on the PDA was associated with BIDR scores, however mean IAT effect assessed on the PDA was not associated with BIDR scores.

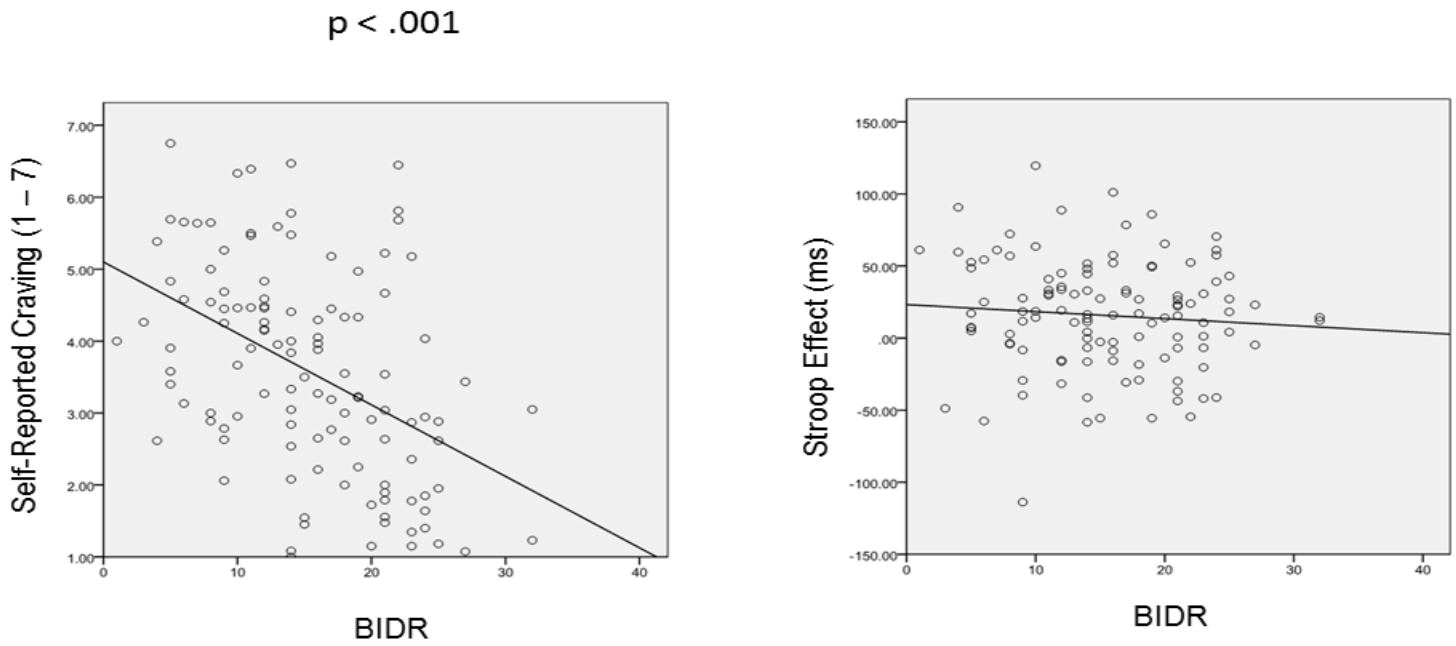


Figure 16. Relationship between craving measures, QSU ratings (explicit craving) and the Stroop effect (a measure of implicit craving),and BIDR scores assessed outside the laboratory on a personal digital assistant (PDA) (Strategy 1); mean explicit craving assessed on the PDA was associated with BIDR scores, however mean implicit craving assessed on the PDA was not associated with BIDR scores.

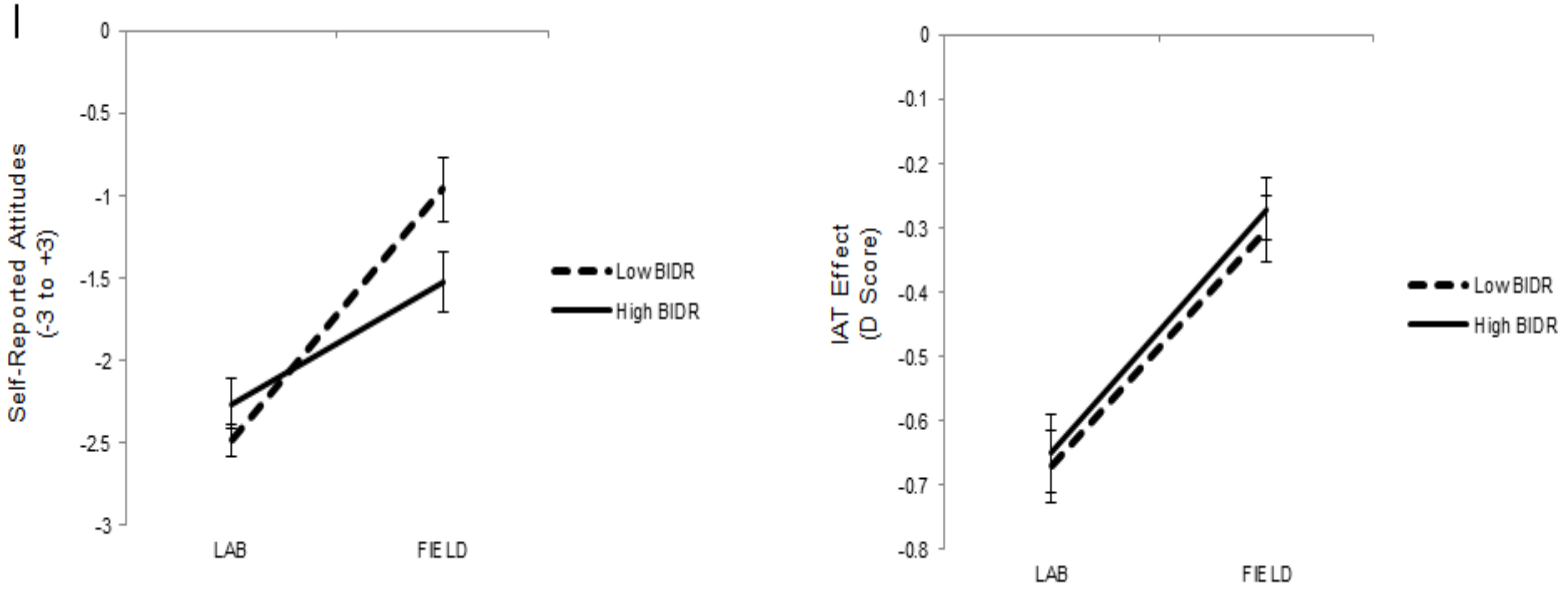


Figure 17. Differences in SDS ratings (explicit attitudes) and IAT effect (implicit attitudes) for low and high BIDR participants for the lab vs. field comparisons (Strategy 1); high BIDR participants reported significantly more negative explicit attitudes in the field but not in the laboratory, however implicit attitudes did not differ significantly between the low and high groups in the laboratory or in the field

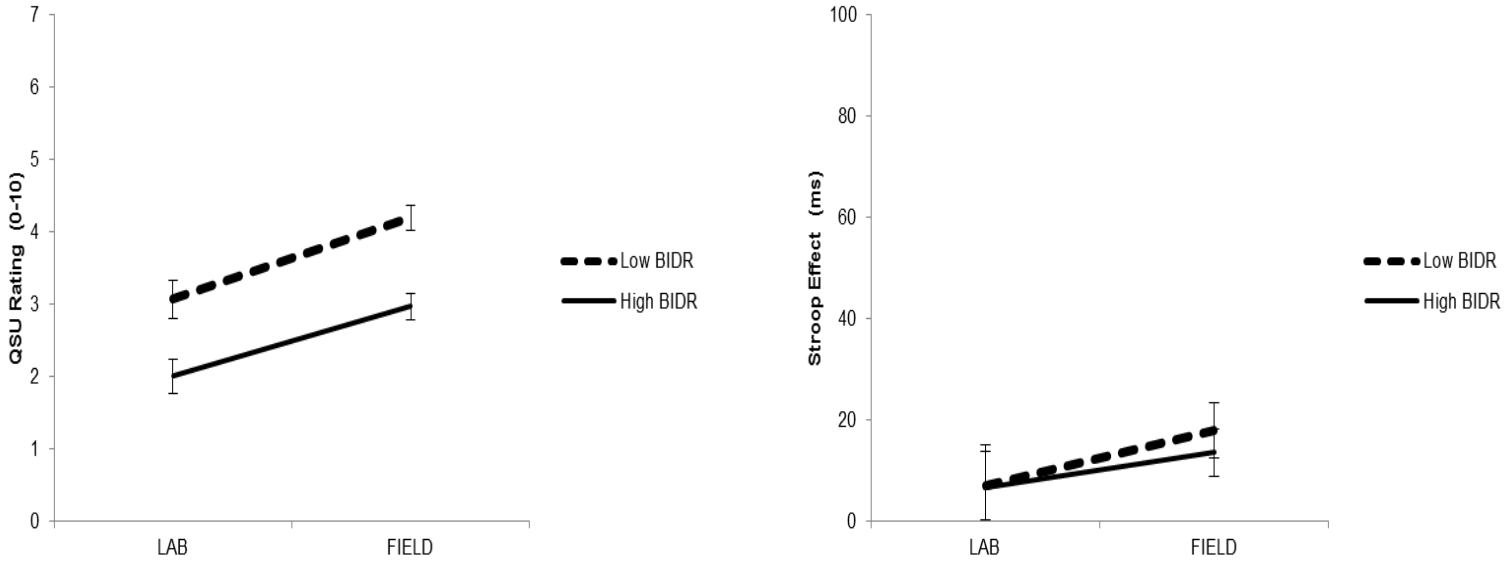


Figure 18. Differences in QSU ratings (explicit craving) and the smoking Stroop effect (implicit craving) for low and high BIDR participants lab vs. field (Strategy 1); neither explicit nor implicit craving differed significantly between the low and high groups in the laboratory or in the field.

Appendix A: IRB Approval Document for MDACC Data

THE UNIVERSITY OF TEXAS
MD ANDERSON
CANCER CENTER
Office of Protocol Research

Institutional Review Board (IRB)
Unit 1437
Phone 713-792-2933
Fax 713-794-4589

To: Paul Cinciripini 03/31/2009
From: Marion B. Olson
CC: Sunetra Martinez, Victoria L. Brown, Evanna L. Thompson, Veronica Roberts
MDACC Protocol ID #: 2005-0741
Protocol Title: Cognitive Processes in Smoking Cessation
Version: 13

Subject: Administrative IRB Approval -- Protocol 2005-0741

On Tuesday, 03/31/2009, the Institutional Review Board (IRB) 4 chair or designee reviewed and approved your revision dated 03/27/2009 for Protocol 2005-0741

These Pages Include:

- Protocol Body -- Document header Date: 03/27/2009

Revision included the following changes:
Clarifying that the de-identified data will be sent to Dr. Andrew Waters and his statistical team at the Uniformed Services University of the Health Sciences.

Additional Revision History:
Please note that along with this revision the M. D. Anderson IRB approves the transfer of de-identified study data for analysis to Dr. Andrew Waters, collaborator on this study, and his statistical team at the Uniformed Services University of the Health Sciences.

The revision can now be implemented. Please inform the appropriate individuals in your department or section and the collaborators of these changes.

Please inform the appropriate individuals in your department/section and your collaborators of these revisions.

Please Note: This approval does not alter or otherwise change the continuing review date of this protocol.

In the event of any questions or concerns, please contact the sender of this message at (713) 792-2933.

Marion B. Olson 03/31/2009 10:02:17 AM

This is a representation of an electronic record that was signed electronically and below is the manifestation of that electronic signature:

Marion B. Olson
03/31/2009 09:51:14 AM

Appendix B: IRB Approval Document for USUHS Data

UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES
4301 JONES BRIDGE ROAD
BETHESDA, MARYLAND 20814-4799
www.usuhs.mil

January 6, 2010

MEMORANDUM FOR ANDREW WATERS, Ph.D., MEDICAL AND CLINICAL PSYCHOLOGY

SUBJECT: USUHS IRB #1 (FWA 00001628; DoD Assurance P60001) Approval of G172JY for Human Subjects Participation

Congratulations! The *Continuing Review and Amendment* for your Minimal Risk human subjects research protocol G172JY, entitled [353030-2] Cognitive Processes in Smoking Cessation, was reviewed and approved for execution on January 6, 2010 by Edmund Howe, MD, JD under the provision of 32 CFR 219.110(b)(1)Suppl. F(7). This approval will be reported to the USUHS IRB #1 scheduled to meet on January 14, 2010.

The majority of smokers are motivated to quit. However, most quit attempts end in failure, with many relapses occurring in the first few days. It is therefore important to understand the mechanisms underlying relapse to smoking, so that more effective interventions can be developed. Most research on the psychological processes underlying relapse has relied on questionnaire (self-report) measures. We are using computerized reaction time tasks, derived from experimental cognitive psychology, to assess processes that may not be captured by self-report. Heavy smokers who wish to quit smoking complete cognitive assessments in a laboratory setting and on a handheld computer for one week after their quit day. The primary specific aim is to examine the associations between the cognitive measures and subsequent relapse to smoking. Results from this study may help us to identify individuals who are high risk for an early relapse, and facilitate the development of smoking cessation interventions.

This action also approves the requested amendment #6, permitting study advertisment through Valpak.

Authorization to conduct protocol G172JY will automatically terminate on January 5, 2011. If you plan to continue data collection or analysis beyond this date, IRB approval for continuation is required. Please submit a USU Form 3204 A/B, application for continuing approval by November 6, 2009. You will receive a reminder from IRBNet.

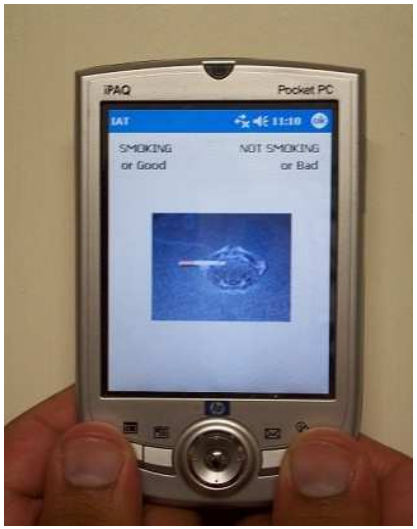
You are required to submit amendments to this protocol, changes to the informed consent document (if applicable), adverse event reports, and other information pertinent to human research for this project in IRBNet. No changes to this protocol may be implemented prior to IRB approval. If you have questions regarding this IRB action or questions of a more general nature concerning human participation in research, please contact Micah Stretch at 301-295-0819 or mstretch@usuhs.mil.

This document has been signed electronically.

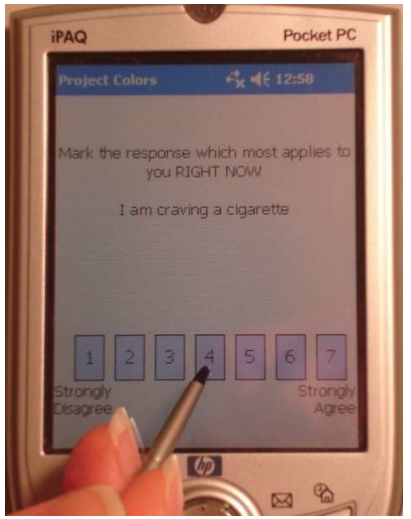
"Electronic Signature Notice: In accordance with the "Government Paperwork Elimination Act" (GPEA) (Pub.L. 105-277; codified at 44 USC 3504); Federal and DOD applicable instructions, directives and regulations, documents have been electronically signed and authorized by all who have been required to do so. These signatures have the same effect as their paper-based counterparts. Verification is retained within our protected electronic records and audit trails."

Appendix C: Pictures of PDA assessments

Modified Stroop Task



Implicit Association Test (IAT)



Self-reported craving item

Appendix D: Balanced Inventory of Desirable Responding, Version 6

BIDR Version 6 – Form 40

Using the scale below as a guide, write a number beside each statement to indicate how much you agree with it.

1--------2--------3--------4--------5--------6--------7
NOT TRUE SOMEWHAT TRUE VERY TRUE

_____ 1. My first impressions of people usually turn out to be right.
_____ 2. It would be hard for me to break any of my bad habits.
_____ 3. I don't care to know what other people really think of me.
_____ 4. I have not always been honest with myself.
_____ 5. I always know why I like things.
_____ 6. When my emotions are aroused, it biases my thinking.
_____ 7. Once I've made up my mind, other people can seldom change my opinion.
_____ 8. I am not a safe driver when I exceed the speed limit.
_____ 9. I am fully in control of my own fate.
_____ 10. It's hard for me to shut off a disturbing thought.
_____ 11. I never regret my decisions.
_____ 12. I sometimes lose out on things because I can't make up my mind soon enough.
_____ 13. The reason I vote is because my vote can make a difference.
_____ 14. My parents were not always fair when they punished me.
_____ 15. I am a completely rational person.
_____ 16. I rarely appreciate criticism.
_____ 17. I am very confident of my judgments.
_____ 18. I have sometimes doubted my ability as a lover.
_____ 19. It's all right with me if some people happen to dislike me.
_____ 20. I don't always know the reasons why I do the things I do.
_____ 21. I sometimes tell lies if I have to.
_____ 22. I never cover up my mistakes.
_____ 23. There have been occasions when I have taken advantage of someone.
_____ 24. I never swear.
_____ 25. I sometimes try to get even rather than forgive and forget.
_____ 26. I always obey laws, even if I'm unlikely to get caught.
_____ 27. I have said something bad about a friend behind his or her back.
_____ 28. When I hear people talking privately, I avoid listening.
_____ 29. I have received too much change from a salesperson without telling him or her.
_____ 30. I always declare everything at customs.
_____ 31. When I was young I sometimes stole things.
_____ 32. I have never dropped litter on the street.
_____ 33. I sometimes drive faster than the speed limit.
_____ 34. I never read sexy books or magazines.
_____ 35. I have done things that I don't tell other people about.
_____ 36. I never take things that don't belong to me.
_____ 37. I have taken sick-leave from work or school even though I wasn't really sick.
_____ 38. I have never damaged a library book or store merchandise without reporting it.
_____ 39. I have some pretty awful habits.
_____ 40. I don't gossip about other people's business.

Appendix E: Semantic Differential Items

Semantic Differential Items

By circling a number from -3 to +3, please rate the degree to which you think smoking is associated with the following adjectives.

- The greater (more positive) number you choose, the more you think that smoking is associated with the word on the right.

- The lesser (more negative) number you choose, the more you think that smoking is associated with the word on the left.

- Circle zero if you think that smoking is not related to the word on the left or the right.

SMOKING is….

Negative Positive

–3 --------- –2 ---------- –1 ---------- 0 ---------- +1 ---------- +2 ---------- +3

Bad Good

–3 --------- –2 ---------- –1 ---------- 0 ---------- +1 ---------- +2 ---------- +3

Unpleasant Pleasant

–3 --------- –2 ---------- –1 ---------- 0 ---------- +1 ---------- +2 ---------- +3

Terrible Wonderful

–3 --------- –2 ---------- –1 ---------- 0 ---------- +1 ---------- +2 ---------- +3

Nasty Nice

–3 --------- –2 ---------- –1 ---------- 0 ---------- +1 ---------- +2 ---------- +3

Appendix F: Questionnaire of Smoking Urges

Questionnaire of Smoking Urges

Instructions: Indicate how much you agree or disagree with each of the following statements by circling the number between strongly disagree and strongly agree. The closer you choose a number to one end or the other indicates the strength of your disagreement or agreement. Please complete every item. We are interested in how you are thinking or feeling **right now** as you are filling out the questionnaire.

	Strongly Disagree					**Strongly Agree**
1. I have a desire for a cigarette.	0	1	2	3	4	5
2. Nothing would be better than smoking a cigarette**.**	0	1	2	3	4	5
3. If it were possible, I probably would smoke a cigarette.	0	1	2	3	4	5
4. I would control things better if I could smoke**.**	0	1	2	3	4	5
5. All I want is a cigarette.	0	1	2	3	4	5
6. I have an urge for a cigarette.	0	1	2	3	4	5
7. A cigarette would taste good**.**	0	1	2	3	4	5
8. I would do almost anything for a cigarette.	0	1	2	3	4	5
9. Smoking would make me less depressed.	0	1	2	3	4	5
10. I am going to smoke as soon as possible.	0	1	2	3	4	5

Appendix G: Smoking Consequences Questionnaire

Smoking Consequences Questionnaire

The questions below describe different beliefs people have about the consequences of smoking a cigarette. For each of the following items, please circle a number that best describes you.

(1) Smoking now would help me relax

1 2 3 4 5 6 7 8 9 10 11

NO!! YES!!

(2) Smoking now would energize me

1 2 3 4 5 6 7 8 9 10 11

NO!! YES!!

(3) A cigarette would taste good now

1 2 3 4 5 6 7 8 9 10 11

NO!! YES!!

(4) Smoking now would satisfy my cravings

1 2 3 4 5 6 7 8 9 10 11

NO!! YES!!

(5) Smoking now would help reduce boredom

1 2 3 4 5 6 7 8 9 10 11

NO!! YES!!

Appendix H: Sample pictures from the smoking IAT

Nonsmoking object (top left), smoking object (bottom left)

Nonsmoking human (top right), and smoking human (bottom right)

Appendix I: Tables for Impression Management (IM) Analyses

Table I1

Differences in Explicit and Implicit Attitudes Toward Smoking for Low and High IM Participants (Strategy 1)

	Self-Report	Low IM M (SD)	High IM M (SD)	ANCOVA Low and High IM (F value)	Implicit	Low IM M (SD)	High IM M (SD)	ANCOVA Low and High IM (F value)	Partial Correlation between SR and Implicit (r) Low IM	Partial Correlation between SR and Implicit (r) High IM
NON	SDS	-1.78 (1.05)	-1.90 (1.12)	.44	IAT effect	-.88 (.52)	-.96 (.49)	2.02	.03	.19
AB	SDS	-1.88 (1.06)	-1.70 (1.22)	1.27	IAT effect	-.78 (.54)	-.85 (.56)	2.17	**.20***	.20
QD	SDS	-2.39 (.85)	-2.28 (1.10)	.68	IAT effect	-.72 (.57)	-.82 (.53)	1.95	.20	**.25***
PDA	PDA Attitude	2.85 (1.35)	2.64 (1.49)	.58	PDA IAT effect	-.33 (.44)	-.27 (.35)	.64	.09	.12
WK+1	SDS	-2.37 (.80)	-2.34 (1.07)	.12	IAT effect	-.69 (.53)	-.63 (.51)	.08	.20	.22
WK+4	SDS	-2.34 (.83)	-2.50 (.94)	1.00	IAT effect	-.72 (.45)	-.77 (.47)	1.59	**.24***	**.34****
Mean	SDS	-2.08 (.76)	-2.06 (1.01)	.01	IAT effect	-.81 (.43)	-.88 (.39)	.79	**.20***	**.28****

Table Note: IM = Impression Management scale of the BIDR; NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = quit day; PDA = assessments given on a personal digital assistant (PDA) for one week following quit day; WK+1 = one week following quit day; WK+4 = four weeks following quit day; Mean = Mean of 5 laboratory sessions; IAT = Implicit Association Test; SDS = Semantic Differentiation Scales (-3 to +3); Ns vary from 199 (NON) to 160 (WK+4); N = 107 included in PDA analyses; *p<.05, **p<.01.

Table I2

Differences in Craving and Attentional Bias Toward Smoking Cues for Low and High IM Participants (Strategy 1)

	Self-Report	Low IM M (SD)	High IM M (SD)	ANCOVA Low and High IM (F value)	Implicit	Low IM M (SD)	High IM M (SD)	ANCOVA Low and High IM (F value)	Partial Correlation between SR and Implicit (r) Low IM	Partial Correlation between SR and Implicit (r) High IM
NON	QSU	3.94 (2.60)	3.06 (2.49)	**6.27****	Stroop effect	33.10 (73.04)	28.10 (10.83)	.28	-.01	-.06
AB	QSU	6.31 (2.13)	5.60 (2.52)	**5.38***	Stroop effect	33.86 (93.07)	3.82 (82.87)	.07	.15	.01
QD	QSU	3.54 (2.24)	2.89 (2.45)	**4.24***	Stroop effect	19.72 (69.41)	11.78 (72.59)	.48	.18	**-.26***
PDA	PDA Craving	4.01 (1.28)	3.15 (1.50)	**11.80****	PDA Stroop effect	23.18 (42.04)	8.60 (33.74)	4.22	.16	-.04
WK+1	QSU	2.29 (1.97)	1.83 (2.09)	2.60	Stroop effect	15.72 (65.38)	-5.75(92.19)	3.60	-.01	.18
WK+4	QSU	1.99 (1.90)	1.63 (2.12)	1.19	Stroop effect	16.45 (78.85)	2.11 (67.18)	.20	.14	.21
Mean	QSU	3.84 (1.72)	3.29 (2.08)	**5.03***	Stroop effect	24.06 (43.48)	2.42 (55.26)	.37	.01	.24

Table Note: IM = Impression Management scale of the BIDR; NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = quit day; PDA = assessments given on a personal digital assistant (PDA) for one week following quit day; WK+1 = one week following quit day; WK+4 = four weeks following quit day; Mean = Mean of 5 laboratory sessions; QSU = Questionnaire for Smoking Urges (0 to 10); Ns vary from 200 (NON) to 160 (WK+4); N = 117 included in PDA analyses; *p<.05, **p<.01.

Table I3

Differences in Explicit and Implicit Expectancies from Smoking for Low and High IM Participants (Strategy 1)

	Self-Report	Low IM M (SD)	High IM M (SD)	ANCOVA Low and High IM (F value)	Implicit	Low IM M (SD)	High IM M (SD)	ANCOVA Low and High IM (F value)	Partial Correlation between SR and Implicit (r)	Partial Correlation between SR and Implicit (r)
									Low IM	High IM
NON	SCQ	5.73 (2.42)	4.86 (2.54)	**5.63***	EA effect	75.28 (487.79)	-57.69 (589.45)	**4.08***	.07	-.00
AB	SCQ	7.43 (2.02)	6.30 (2.34)	**11.70****	EA effect	155.24 (547.77)	35.43 (617.21)	1.90	**.24***	**.22***
QD	SCQ	5.15 (2.54)	4.43 (2.71)	3.52	EA effect	4.68 (412.15)	-153.02 (587.75)	2.57	.18	.22
WK+1	SCQ	4.06 (2.39)	3.34 (2.45)	**3.77***	EA effect	-15.61 (598.47)	-214.93 (684.47)	**5.66***	.11	**.28***
WK+4	SCQ	3.76 (2.41)	2.77 (2.12)	**6.79****	EA effect	-123.87 (506.84)	-23.01 (579.53)	1.88	**.39****	**.43****
Mean	SCQ	5.42 (1.85)	4.59 (2.13)	**8.31****	EA effect	46.52 (354.53)	-89.58 (501.01)	**4.92***	**.30****	**.42****

Table Note: IM = Impression Management scale of the BIDR; NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = quit day; WK+1 = one week following quit day; WK+4 = four weeks following quit day; Mean = Mean of 5 laboratory sessions;; EA = Expectancy Accessibilty; SCQ = Smoking Consequences items (0 - 10); Ns vary from 196 (NON) to 160 (WK+4); *p<.05, **p<.01.

Table I4

Correlations Between IM Scores and Explicit and Implicit Attitudes Toward Smoking (Strategy 2)

	Self-report	Partial Correlation between IM and Self-Report (r)	Implicit	Partial Correlation between IM and Implicit (r)	Moderation Effect Regression (b value)
NON	Explicit Attitudes	-.13	IAT effect	-.06	b = .038 (SE = .019) ΔR^2 = .050
AB	Explicit Attitudes	.01	IAT effect	-.05	b = -.044 (SE = .019) ΔR^2 = .081
QD	Explicit Attitudes	-.05	IAT effect	-.13	b = .041 (SE = .017) ΔR^2 = .053
PDA	PDA Attitudes	-.19	PDA IAT effect	.06	b = .044 (SE = .044) ΔR^2 = .020
WK+1	Explicit Attitudes	-.06	IAT effect	-.12	b = .040 (SE = .018) ΔR^2 = .078
WK+4	Explicit Attitudes	-.14	IAT effect	.02	b = .057 (SE = .017) ΔR^2 = .016
Mean	Explicit Attitudes	-.08	IAT effect	-.07	b = .054 (SE = .016) ΔR^2 = .091

Table Note: IM = Impression Management scale of the BIDR; NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = quit day; PDA = assessments given on a personal digital assistant (PDA) for one week following quit day; WK+1 = one week following quit day; WK+4 = four weeks following quit day; Mean = Mean of 5 laboratory sessions; IAT = Implicit Association Test; Explicit Attitudes = Semantic Differentiation Scales (-3 to +3); Ns range from 193 (NON) to 150 (WK+4); N = 105 included in PDA analyses; *p<.05, **p<.01. r values are Pearson correlation coefficients; b values for moderation effect are unstandardized regression coefficients for the interaction between IM scores and implicit measures in regression analysis (see text)

Table I5

Correlations Between IM Scores and Craving and Attentional Bias Toward Smoking Cues (Strategy 2)

	Self-report	Partial Correlation between IM and Self-Report (r)	Implicit	Partial Correlation between IM and Implicit (r)	Moderation Effect Regression (b value)
NON	QSU	**-.21****	Stroop effect	.04	b = .000 (SE = .000) ΔR^2 = .000
AB	QSU	-.11	Stroop effect	-.06	b = .000 (SE = .000) ΔR^2 = .009
QD	QSU	**-.22****	Stroop effect	-.06	b = .000 (SE = .000) ΔR^2 = .018
PDA	PDA Craving	**-.35****	PDA Stroop effect	-.14	b = .000 (SE = .000) ΔR^2 = .006
WK+1	QSU	-.12	Stroop effect	-.12	b = .000 (SE = .000) ΔR^2 = .001
WK+4	QSU	-.06	Stroop effect	.08	b = .000 (SE = .000) ΔR^2 = .039
Mean	QSU	**-.19****	Stroop effect	-.03	b = .001 (SE = .000) ΔR^2 = .069

Table Note: IM = Impression Management scale of the BIDR; NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = quit day; PDA = assessments given on a personal digital assistant (PDA) for one week following quit day; WK+1 = one week following quit day; WK+4 = four weeks following quit day; Mean = Mean of 5 laboratory sessions; QSU = Questionnaire for Smoking Urges (0 to 10); Ns range from 194 (NON) to 153 (WK+4); N = 115 included in PDA analyses; *p<.05, **p<.01. r values are Pearson correlation coefficients; b values for moderation effect are unstandardized regression coefficients for the interaction between IM scores and implicit measures in regression analysis (see text)

Table I6

Correlations Between IM Scores and Explicit and Implicit Expectancies from Smoking (Strategy 2)

	Self-report	Partial Correlation between IM and Self-Report (r)	Implicit	Partial Correlation between IM and Implicit (r)	Moderation Effect Regression (b value)
NON	SCQ	**-.23****	EA effect	-.11	b = .000 (SE = .000) ΔR^2 = .001
AB	SCQ	**-.15***	EA effect	-.10	b = .000 (SE = .000) ΔR^2 = .081
QD	SCQ	**-.24****	EA effect	**-.15***	b = .000 (SE = .000) ΔR^2 = .048
WK+1	SCQ	-.14	EA effect	**-.18***	b = .000 (SE = .000) ΔR^2 = .110
WK+4	SCQ	**-.19***	EA effect	**-.19***	b = .000 (SE = .000) ΔR^2 = .104
Mean	SCQ	**-.27****	EA effect	**-.15***	b = .000 (SE = .000) ΔR^2 = .131

Table Note: IM = Impression Management scale of the BIDR; NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = quit day; PDA = assessments given on a personal digital assistant (PDA) for one week following quit day; WK+1 = one week following quit day; WK+4 = four weeks following quit day; Mean = Mean of 5 laboratory sessions; EA = Expectancy Accessibilty; SCQ = Smoking Consequences items (0 - 10); Ns range from 188 (NON) to 133 (WK+4); *p<.05, **p<.01. r values are Pearson partial correlation coefficients; b values for moderation effect are unstandardized regression coefficients for the interaction between IM scores and implicit measures in regression analysis (see text)

Table I7

Effect of IM Across States, NON vs. AB sessions (Strategy 1 and 2)

	NON session		AB session					
	Low IM M (SD)	High IM M (SD)	Low IM M (SD)	High IM M (SD)	Main Effect of State (F value)	Main Effect of dich. SDE (F value)	Interaction: State x dich. IM (F Value)	Interaction: State x cont. IM (F Value)
SDS	-1.77 (1.05)	-1.90 (1.12)	-1.88 (1.06)	-1.70 (1.22)	.20	.02	1.89	2.37
QSU	3.94 (2.60)	3.06 (2.49)	6.31 (2.13)	5.60 (2.52)	**11.45****	**8.79****	.02	1.32
SCQ	5.73 (2.42)	4.86 (2.54)	7.43 (2.02)	6.30 (2.34)	**5.60***	**11.29****	1.05	.83
IAT	-.88 (.52)	-.96 (.49)	-.78 (.54)	-.85 (.56)	.14	3.26	.45	.02
Stroop	33.10 (73.04)	28.10 (10.83)	33.86 (93.07)	3.82 (82.87)	.33	.68	.07	1.05
EA	75.28 (487.79)	-57.69 (589.45)	155.24 (547.77)	35.43 (617.21)	.24	**4.38***	.27	.05

Table Note: Hypotheses 4A, 4B, and 4C. The F value for the State x dich. (dichotomous) SDR = interaction effect for Strategy 2. The F value for the State x cont. (continuous) SDR = interaction effect for Strategy 1. IM = Impression Management scale of BIDR; NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); SDS = Semantic Differential Scales (-3 to +3); QSU = Questionnaire of Smoking Urges (0 -10); SCQ = Smoking Consequences items (0 - 10); IAT = Implicit Association Test; Stroop = Smoking Stroop Task; EA = Expectancy Accessibilty; N = 178 for NON and AB sessions (participants who completed both sessions); *p<.05, **p<.01

Table I8

Effect of IM Across States, AB vs. QD sessions (Strategy 1 and 2)

	AB session		QD session					
	Low IM M (SD)	High IM M (SD)	Low IM M (SD)	High IM M (SD)	Main Effect of State (F value)	Main Effect of dich. IM (F value)	Interaction: State x dich. IM (F Value)	Interaction: State x cont. IM (F Value)
SDS	-1.88 (1.06)	-1.70 (1.22)	-2.39 (.85)	-2.28 (1.10)	1.56	1.29	.28	2.48
QSU	6.31 (2.13)	5.60 (2.52)	3.54 (2.24)	2.89 (2.45)	**5.37***	**6.20****	.02	.90
SCQ	7.43 (2.02)	6.30 (2.34)	5.15 (2.54)	4.43 (2.71)	**4.01***	**8.23****	.48	.67
IAT	-.78 (.54)	-.85 (.56)	-.72 (.57)	-.82 (.53)	.80	3.02	.03	.01
Stroop	33.86 (93.07)	3.82 (82.87)	19.72 (69.41)	11.78 (72.59)	.73	.52	.02	3.68
EA	155.24 (547.77)	35.43 (617.21)	4.68 (412.15)	-153.02 (587.75)	1.06	3.72	.02	.46

Table Note: Hypotheses4A, 4B, and 4C. The F value for the State x dich. (dichotomous) SDR = interaction effect for Strategy 2. The F value for the State x cont. (continuous) SDR = interaction effect for Strategy 1. IM = Impression Management scale of BIDR; AB = 12 hour abstinent session (pre-quit); QD = quit day; SDS = Semantic Differential Scales (-3 to +3); QSU = Questionnaire of Smoking Urges (0 -10); SCQ = Smoking Consequences items (0 - 10); IAT = Implicit Association Test; Stroop = Smoking Stroop Task; EA = Expectancy Accessibilty; N = 169 for NON and AB sessions (participants who completed both sessions); *p<.05, **p<.01

Table I9

Effect of IM Across Settings, Lab vs. Field (Strategy 1 and 2)

	Lab			Field					
	Low IM M (SD)	High IM M (SD)		Low IM M (SD)	High IM M (SD)	Main Effect of Setting (F value)	Main Effect of dich. IM (F Value)	Interaction: Setting x dich. IM (F Value)	Interaction: Setting x cont. IM (F Value)
SDS	-2.39 (.73)	-2.30 (1.05)	PDA Attitudes	-1.15 (1.35)	-1.36 (1.49)	1.73	.00	**3.96***	**6.38****
QSU	2.99 (1.90)	2.42 (2.02)	PDA Craving	4.01 (1.28)	3.15 (1.50)	**5.29***	**8.25****	.21	.00
IAT	-.62 (.50)	-.73 (.49)	PDA IAT	-.33 (.44)	-.27 (.35)	**13.93****	.28	.00	.01
Stroop	19.06 (47.21)	2.65 (63.55)	PDA Stroop	23.18 (42.04)	8.60 (33.74)	.00	3.54	.23	.06

Table Note: Data pertain to Hypotheses 5A, 5B, 5C, and 5D. The F value for the Setting x dich. (dichotomous) SDR interaction term tests the interaction effect for Strategy 2. The F value for the Setting x cont. (continuous) SDR interaction term tests the interaction effect for Strategy 1. IM = Impression Management scale of the Balanced Inventory of Desirable Responding; Lab = mean of assessments given in laboratory on quit day and one week after quit day (WK+1); Field = mean of assessments given on PDA during the week between quit day and one week after quit day (WK+1); SDS = Semantic Differential Scales (-3 to +3); QSU = Questionnaire of Smoking Urges (Range 0 -10); IAT = Implicit Association Test; Stroop = Smoking Stroop Task; Ns ranged from 107-117 for AB and QD sessions; *p<.05, **p<.01

Appendix J: Tables for Self-Deceptive Enhancement (SDE) Analyses

Table J1

Differences in Explicit and Implicit Attitudes Toward Smoking for Low and High SDE Participants (Strategy 1)

	Self-Report	Low SDE M (SD)	High SDE M (SD)	ANCOVA Low and High BIDR (F value)	Implicit	Low SDE M (SD)	High SDE M (SD)	ANCOVA Low and High BIDR (F value)	Partial Correlation between SR and Implicit (r) Low SDE	Partial Correlation between SR and Implicit (r) High SDE
NON	SDS	-1.77 (1.04)	-1.90 (1.13)	1.63	IAT effect	-.93 (.50)	-.91 (.52)	.15	.02	.19
AB	SDS	-1.77 (1.15)	-1.81 (1.13)	.55	IAT effect	-.82 (.54)	-.81 (.56)	.29	.16	.20
QD	SDS	-2.42 (.83)	-2.26 (1.10)	.03	IAT effect	-.76 (.56)	-.77 (.55)	1.09	**.29****	.20
PDA	PDA Attitude	2.99 (1.42)	2.53 (1.41)	2.87	PDA IAT effect	-.28 (.34)	-.31 (.45)	.49	.05	.13
WK+1	SDS	-2.33 (.81)	-2.38 (1.04)	.94	IAT effect	-.59 (.53)	-.57 (.53)	.42	.13	**.25***
WK+4	SDS	-2.38 (.81)	-2.45 (.96)	.63	IAT effect	-.73 (.49)	-.59 (.54)	.54	**.34****	**.25***
Mean	SDS	-2.04 (.80)	-2.10 (.97)	1.74	IAT effect	-.76 (.44)	-.73 (.47)	.26	**.28****	.19

Table Note: SDE = Self-Deceptive Enhancement scale of BIDR; NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = quit day; PDA = assessments given on a personal digital assistant (PDA) for one week following quit day; WK+1 = one week following quit day; WK+4 = four weeks following quit day; Mean = Mean of 5 laboratory sessions; IAT = Implicit Association Test; SDS = Semantic Differentiation Scales (-3 to +3); Ns vary from 199 (NON) to 152 (WK+4); N = 107 included in PDA Attitude analyses and N = 114 included in PDA analyses; *p<.05, **p<.01.

Table J2

Differences in Craving and Attentional Bias Toward Smoking Cues for Low and High SDE Participants (Strategy 1)

	Self-Report	Low SDE M (SD)	High SDE M (SD)	ANCOVA Low and High SDE (F value)	Implicit	Low SDE M (SD)	High SDE M (SD)	ANCOVA Low and High SDE (F value)	Partial Correlation between SR and Implicit (r) Low SDE	Partial Correlation between SR and Implicit (r) High SDE
NON	QSU	3.80 (2.60)	3.26 (2.55)	1.19	Stroop effect	22.00 (8.41)	39.38 (92.37)	**4.25***	-.03	.04
AB	QSU	6.21 (2.21)	5.73 (2.45)	2.42	Stroop effect	33.99 (93.52)	3.70 (82.44)	.39	.08	.06
QD	QSU	3.83 (2.17)	2.63 (2.40)	**14.01****	Stroop effect	9.10 (78.70)	22.59 (62.05)	1.01	**.24***	**-.31****
PDA	PDA Craving	4.10 (1.26)	3.09 (1.46)	**11.21****	PDA Stroop effect	12.85 (42.09)	18.49 (35.12)	.01	.17	.17
WK+1	QSU	2.49 (1.91)	1.67 (2.08)	**8.92****	Stroop effect	4.71 (81.42)	6.64 (78.10)	.20	-.00	-.04
WK+4	QSU	2.22 (2.08)	1.42 (1.87)	**4.53***	Stroop effect	23.48 (74.86)	12.94 (71.97)	.52	-.04	.18
Mean	QSU	4.00 (1.92)	3.15 (1.83)	**1.26****	Stroop effect	2.95 (45.47)	23.67 (63.68)	.29	.17	**.23***

Table Note: SDE = Self-Deceptive Enhancement scale of BIDR; NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = quit day; PDA = assessments given on a personal digital assistant (PDA) for one week following quit day; WK+1 = one week following quit day; WK+4 = four weeks following quit day; Mean = Mean of 5 laboratory sessions;; QSU = Questionnaire for Smoking Urges (0 to 10); Ns vary from 200 (NON) to 155 (WK+4); N = 116 included in PDA analyses; *p<.05, **p<.01

Table J3

Differences in Explicit and Implicit Expectancies from Smoking for Low and High SDE Participants (Strategy 1)

	Self-Report	Low SDE M (SD)	High SDE M (SD)	ANCOVA Low and High SDE (F value)	Implicit	Low SDE M (SD)	High SDE M (SD)	ANCOVA Low and High SDE (F value)	Partial Correlation between SR and Implicit (r) Low SDE	Partial Correlation between SR and Implicit (r) High SDE
NON	SCQ	5.70 (2.46)	4.95 (2.51)	2.21	EA effect	88.63 (565.65)	-6.24 (502.11)	1.43	.07	.11
AB	SCQ	7.19 (2.13)	6.58 (2.32)	**4.04***	EA effect	156.22 (578.93)	37.02 (585.30)	2.35	**.25***	**.24***
QD	SCQ	5.61 (2.32)	4.01 (2.71)	**17.40****	EA effect	5.29 (441.88)	-14.18 (553.78)	2.75	**.23***	.17
WK+1	SCQ	4.28 (2.40)	3.17 (2.35)	**9.06****	EA effect	-37.25 (627.55)	-206.11 (659.94)	3.53	.13	**.28***
WK+4	SCQ	3.94 (2.45)	2.71 (2.12)	**7.39****	EA effect	-72.85 (486.66)	-278.32 (578.80)	**4.31***	**.36****	**.46****
Mean	SCQ	5.61 (1.90)	4.43 (2.03)	**16.62****	EA effect	54.47 (397.19)	-91.01 (459.05)	**4.75***	**.33****	**.41****

Table Note: SDE = Self-Deceptive Enhancement scale of the Balanced Inventory of Desirable Responding; NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = participants' quit day; WK+1 = one week following participants' quit day; WK+4 = four weeks following participants' quit day; Mean = Mean of 5 laboratory sessions;; EA = Expectancy Accessibilty; SCQ = Smoking Consequences items (Range 0 - 10); Ns vary from 196 (NON) to 135 (WK+4); *p<.05, **p<.01

Table J4

Correlations Between SDE Scores and Explicit and Implicit Attitudes Toward Smoking (Strategy 2)

	Self-report	Partial Correlation between SDE and Self-Report (r)	Implicit	Partial Correlation between SDE and Implicit (r)	Moderation Effect Regression (b value)
NON	Explicit Attitudes	**-.14***	IAT effect	-.05	b = .029 (SE = .017) ΔR^2 = .035
AB	Explicit Attitudes	-.07	IAT effect	-.05	b = -.038 (SE = .018) ΔR^2 = .075
QD	Explicit Attitudes	.00	IAT effect	-.10	b = .054 (SE = .015) ΔR^2 = .107
PDA	PDA Attitudes	**-.23***	PDA IAT effect	-.04	b = .024 (SE = .038) ΔR^2 = .007
WK+1	Explicit Attitudes	-.09	IAT effect	-.07	b = -.046 (SE = .015) ΔR^2 = .112
WK+4	Explicit Attitudes	-.15	IAT effect	.04	b = -.045 (SE = .016) ΔR^2 = .092
Mean	Explicit Attitudes	-.14	IAT effect	-.05	b = .046 (SE = .015) ΔR^2 = .074

Table Note: SDE = Self-Deceptive Enhancement scale of BIDR; NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = quit day; PDA = assessments given on a personal digital assistant (PDA) for one week following quit day; WK+1 = one week following quit day; WK+4 = four weeks following quit day; Mean = Mean of 5 laboratory sessions; IAT = Implicit Association Test; Explicit Attitudes = Semantic Differentiation Scales (-3 to +3); Ns range from 193 (NON) to 150 (WK+4); N = 105 included in PDA analyses; *p<.05, **p<.01. r values are Pearson correlation coefficients; b values for moderation effect are unstandardized regression coefficients for the interaction between SDE scores and implicit measures in regression analysis (see text)

Table J5

Correlations Between SDE Scores and Craving and Attentional Bias Toward Smoking Cues (Strategy 2)

	Self-report	Partial Correlation between SDE and Self-Report (r)	Implicit	Partial Correlation between SDE and Implicit (r)	Moderation Effect Regression (b value)
NON	QSU	-.10	Stroop effect	**.17***	b = .000 (SE = .000) ΔR^2 = .001
AB	QSU	-.10	Stroop effect	-.10	b = .000 (SE = .000) ΔR^2 = .004
QD	QSU	**-.26****	Stroop effect	.13	b = -.001 (SE = .000) ΔR^2 = .02
PDA	PDA Craving	**-.40****	PDA Stroop effect	-.08	b = .000 (SE = .000) ΔR^2 = .010
WK+1	QSU	**-.24****	Stroop effect	-.08	b = -.000 (SE = .000) ΔR^2 = .004
WK+4	QSU	**-.22****	Stroop effect	-.04	b = .000 (SE = .000) ΔR^2 = .013
Mean	QSU	**-.23****	Stroop effect	.04	b = .001 (SE = .000) ΔR^2 = .062

Table Note: SDE = Self-Deceptive Enhancement scale of BIDR; NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = quit day; PDA = assessments given on a personal digital assistant (PDA) for one week following quit day; WK+1 = one week following quit day; WK+4 = four weeks following quit day; Mean = Mean of 5 laboratory sessions; QSU = Questionnaire for Smoking Urges 0 to 10); Ns range from 194 (NON) to 153 (WK+4); N = 115 included in PDA analyses; *p<.05, **p<.01. r values are Pearson correlation coefficients; b values for moderation effect are unstandardized regression coefficients for the interaction between SDE scores and implicit measures in regression analysis (see text)

Table J6

Correlations Between SDE Scores and Explicit and Implicit Expectancies from Smoking (Strategy 2)

	Self-report	Partial Correlation between SDE and Self-Report (r)	Implicit	Partial Correlation between SDE and Implicit (r)	Moderation Effect Regression (b value)
NON	SCQ	**-.14***	EA effect	-.06	b = .000 (SE = .000) ΔR^2 = .014
AB	SCQ	-.11	EA effect	**-.16***	b = .000 (SE = .000) ΔR^2 = .121
QD	SCQ	**-.28****	EA effect	**-.18***	b = .000 (SE = .000) ΔR^2 = .036
WK+1	SCQ	**-.27****	EA effect	-.14	b = .000 (SE = .000) ΔR^2 = .077
WK+4	SCQ	**-.24****	EA effect	**-.18***	b = .000 (SE = .000) ΔR^2 = .083
Mean	SCQ	**-.28****	EA effect	**-.17***	b = .000 (SE = .000) ΔR^2 = .050

Table Note: SDE = Self-Deceptive Enhancement scale of BIDR; NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); QD = quit day; WK+1 = one week following quit day; WK+4 = four weeks following quit day; Mean = Mean of 5 laboratory sessions;; EA = Expectancy Accessibilty; SCQ = Smoking Consequences items (0 - 10); Ns range from 190 (NON) to 133 (WK+4); *p<.05, **p<.01. r values are Pearson correlation coefficients; b values for moderation effect are unstandardized regression coefficients for the interaction between SDE scores and implicit measures in regression analysis (see text)

Table J7

Effect of SDE Across States, NON vs. AB Sessions (Strategy 1 and 2)

	NON session		AB session					
	Low SDE M (SD)	High SDE M (SD)	Low SDE M (SD)	High SDE M (SD)	Main Effect of State (F value)	Main Effect of dich. IM (F value)	Interaction: State x dich. SDE (F Value)	Interaction: State x cont. SDE (F Value)
SDS	-1.77 (1.04)	-1.97 (1.12)	-1.77 (1.08)	-1.83 (1.15)	.06	.99	.55	1.44
QSU	3.80 (2.60)	2.99 (2.48)	6.17 (2.17)	6.21 (2.21)	**11.65****	2.75	.03	.24
SCQ	5.70 (2.46)	4.87 (2.49)	7.11 (2.18)	7.19 (2.13)	**6.52****	3.52	.08	.26
IAT	-.93 (.50)	-.94 (.50)	-.81 (.54)	-.82 (.54)	.23	.56	.00	.12
Stroop	22.00 (8.41)	36.41 (88.72)	37.60 (92.31)	33.99 (93.52)	.19	.90	3.37	**5.61***
EA	88.63 (565.65)	-68.89 (542.49)	168.47 (561.57)	156.22 (578.93)	.24	2.88	.02	2.10

Table Note: Hypotheses 4A, 4B, and 4C. The F value for the State x dich. (dichotomous) SDR = interaction effect for Strategy 2. The F value for the State x cont. (continuous) SDR = interaction effect for Strategy 1. SDE = Self-Deceptive Enhancement scale of BIDR; NON = Non-abstinent session (pre-quit); AB = 12 hour abstinent session (pre-quit); SDS = Semantic Differential Scales (-3 to +3); QSU = Questionnaire of Smoking Urges (0 -10); SCQ = Smoking Consequences items (0 - 10); IAT = Implicit Association Test; Stroop = Smoking Stroop Task; EA = Expectancy Accessibilty; N = 178 for NON and AB sessions (participants who completed both sessions); *p<.05, **p<.01.

Table J8

Effect of SDE Across States, AB vs. QD sessions (Strategy 1 and 2)

	AB session		QD session					
	Low SDE M (SD)	High SDE M (SD)	Low SDE M (SD)	High SDE M (SD)	Main Effect of State (F value)	Main Effect of dich. SDE (F Value)	Interaction: State x dich. SDE (F Value)	Interaction: State x cont. SDE (F Value)
SDS	-1.77 (1.15)	-1.81 (1.13)	-2.42 (.83)	-2.26 (1.10)	1.23	.08	.59	.22
QSU	6.21 (2.21)	5.73 (2.45)	3.83 (2.17)	2.63 (2.40)	**6.61****	**8.44****	**5.96***	**5.85***
SCQ	7.19 (2.13)	6.58 (2.32)	5.61 (2.32)	4.01 (2.71)	**6.01***	**11.31****	**8.61****	**8.22****
IAT	-.82 (.54)	-.81 (.56)	-.76 (.56)	-.77 (.55)	.64	.90	.83	.63
Stroop	33.99 (93.52)	3.70 (82.44)	9.10 (78.70)	22.59 (62.05)	.55	.06	2.73	**4.80***
EA	156.22 (578.93)	37.02 (585.30)	5.29 (441.88)	-14.18 (553.78)	1.01	2.92	.04	.07

Table Note: Hypotheses4A, 4B, and 4C. The F value for the State x dich. (dichotomous) SDR = interaction effect for Strategy 2. The F value for the State x cont. (continuous) SDR = interaction effect for Strategy 1. SDE = Self-Deceptive Enhancement scale of BIDR; AB = 12 hour abstinent session (pre-quit); QD = quit day; SDS = Semantic Differential Scales (-3 to +3); QSU = Questionnaire of Smoking Urges (0 -10); SCQ = Smoking Consequences items (0 - 10); IAT = Implicit Association Test; Stroop = Smoking Stroop Task; EA = Expectancy Accessibilty; N = 169 for NON and AB sessions (participants who completed both sessions); *p<.05, **p<.01

Table J9

Effect of SDE Across Settings, Lab vs. Field (Strategy 1 and 2)

	Lab			Field					
	Low SDE M (SD)	High SDE M (SD)		Low SDE M (SD)	High SDE M (SD)	Main Effect of Setting (F value)	Main Effect of dich. SDE (F Value)	Interaction: Setting x dich. SDE (F Value)	Interaction: Setting x cont. SDE (F Value)
SDS	-2.39 (.71)	-2.31 (1.04)	PDA Attitudes	-1.01 (1.42)	-1.47 (1.41)	2.03	1.25	**4.40***	**5.10***
QSU	3.24 (1.90)	2.20 (1.92)	PDA Craving	4.10 (1.26)	3.09 (1.46)	**5.98***	**14.26****	2.31	.33
IAT	-.67 (.51)	-.68 (.49)	PDA IAT	-.28 (.34)	-.31 (.45)	**14.03****	.15	.00	.07
Stroop	7.69 (59.13)	15.14 (52.47)	PDA Stroop	12.85 (42.09)	18.49 (35.12)	.01	.53	.26	.75

Table Note: Hypotheses 5A, 5B, 5C, and 5D. The F value for the Setting x dich. (dichotomous) SDR = interaction effect for Strategy 2. The F value for the Setting x cont. (continuous) SDR = interaction effect for Strategy 1. SDE = Self-Deceptive Enhancement scale of BIDR; Lab = mean of assessments given in laboratory on quit day and one week after quit day (WK+1); Field = mean of assessments given on PDA during the week between quit day and one week after quit day (WK+1); SDS = Semantic Differential Scales (-3 to +3); QSU = Questionnaire of Smoking Urges (0 - 10); IAT = Implicit Association Test; Stroop = Smoking Stroop Task; N = 107 for AB and QD sessions (participants who completed both sessions); *p<.05, **p<.01